NEW ZEALAND JOURNAL OF

Agriculture

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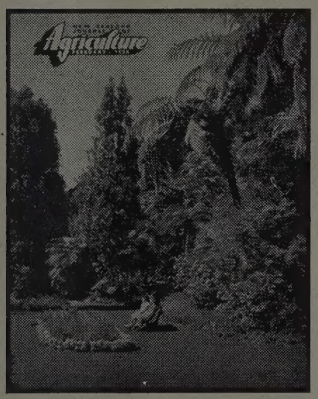
This Month's Cover



A restful corner of Pukekura Park, New Plymouth, one of the most beautiful of New Zealand's many public parks and gardens, is the subject of this month's cover. It has been reproduced from a colour photograph by National Publicity Studios. Retention of belts of native bush in an almost undisturbed state and merging of them with suitable arrangements of introduced species of trees and shrubs are features of parks in many towns and in the cities. The combination has been notably effected at Pukekura Park, from parts of which there are also magnificent vistas of Mt. Egmont.

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TABLE OF CONTENTS

Plant Quarantine in New Zealand since 1884 ..	G. A. H. Helson ..	115
Care of Livestock during March	.. ..	124
Dairy Produce Graded for Export	.. .. ..	124
Pasture Management in Autumn (Seasonal Notes)	.. .. ..	125
Honey House Construction and Layout of Plant	L. H. Johnson ..	126
Radio Broadcasts	.. .. ..	128
Choice and Purchase of Near-to-lay Pullets for Household Flocks	H. H. Watson	129
The Home Garden	A. G. Kennelly ..	131
Management of Harper Adams Pig Fattening House	E. D. Edwards	141
Pedigree Sow Records	.. ..	144
Domestic Beekeeping	D. Roberts	147
Poultry Husbandry in Britain	F. C. Bobby ..	151
Meteorological Records for December	.. .. ..	156
Show Dates	.. .. ..	156
Cover Crops in the Home Orchard	K. Stagg ..	157
Research Work on Maturation of Grapes ..	D. S. Kasza ..	159
Wheat Growing in Canterbury	W. V. Hadfield ..	161
History of Fruit Growing in Central Otago ..	W. S. Kemp ..	169
Recent Research Work: Weed Control	.. .. ..	187
Control of Water Hyacinth in Rotorua District ..	C. R. Taylor ..	188
Molybdate Topdressing and Animal Health ..	I. J. Cunningham ..	196
Recipes Requiring Milk	Maud B. Strain ..	203
Choice and Care of Nylon Stockings	Lesley Harding ..	209
Sugared Fruits	Betty M. Johnston ..	212
Use of Herbs in Cookery	Nell Macpherson ..	214
The Flower Garden	K. H. Marcussen and M. Joanna Lockie	215
Trimming a Small Hat Shape	Betty M. Johnston ..	224

SUBSCRIPTION RATES

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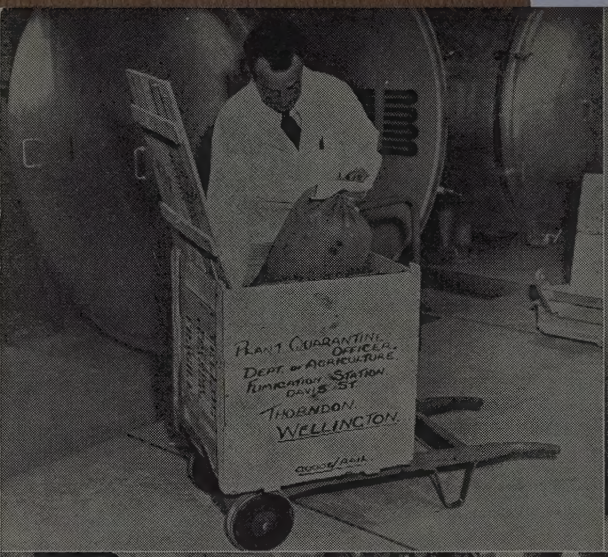
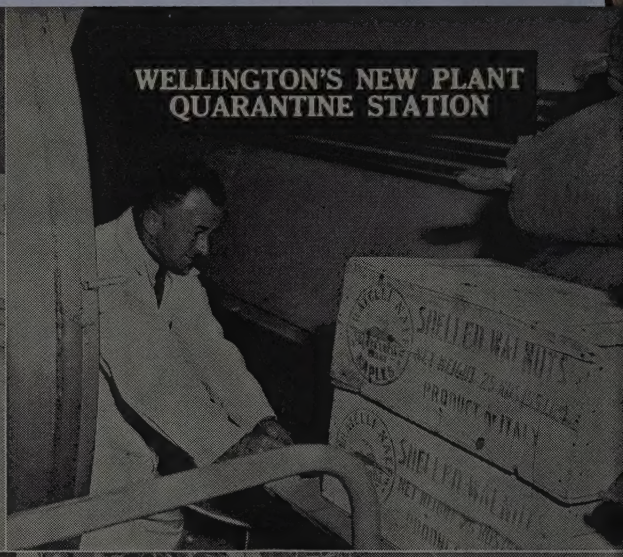
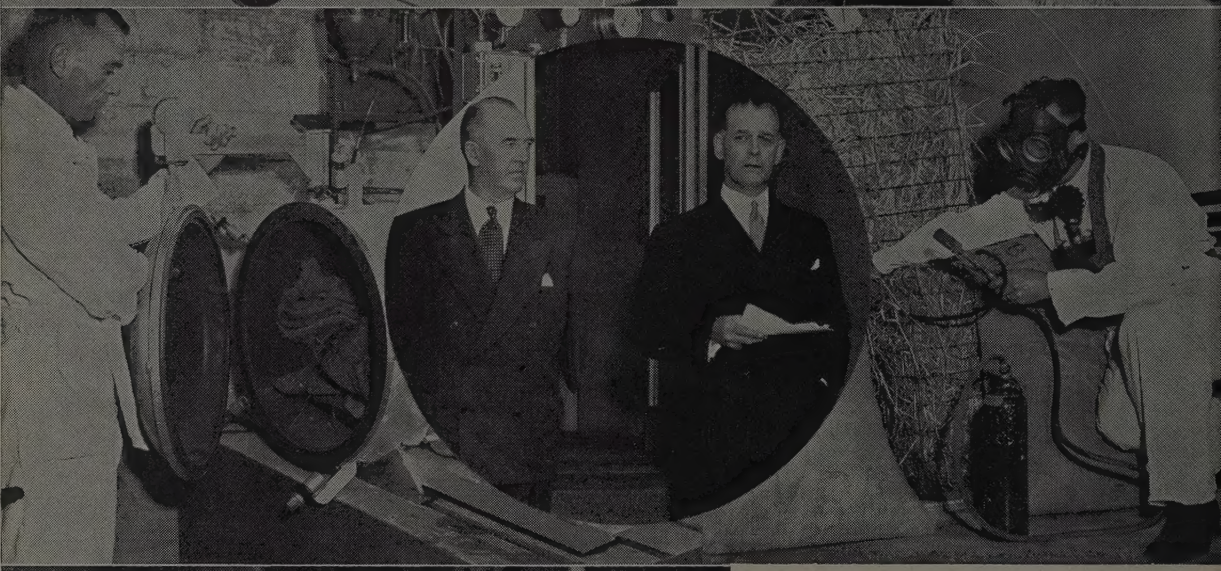
30 MAR 1955

WELLINGTON'S NEW PLANT QUARANTINE STATION

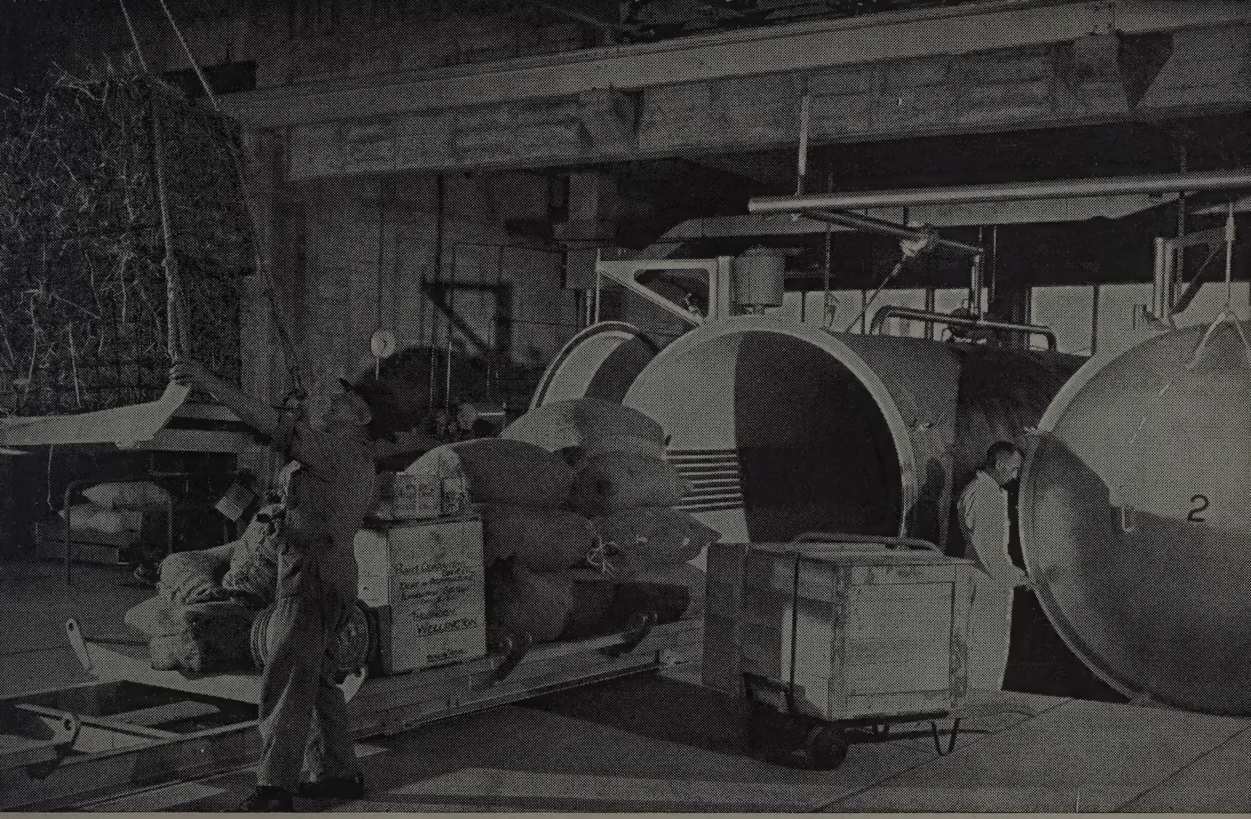






The new Plant Quarantine Station recently opened in Wellington has the most up-to-date equipment possible to carry out the various important duties of the Service. Upper left—An officer unpacking a consignment sent in for fumigation. In the background are the two vacuum fumigation cylinders. Upper right—A charge of foodstuffs being placed in a vacuum fumigator for treatment with methyl bromide. Middle left—Second-hand sacking is placed in a small vacuum fumigation cylinder. Middle right—An operator wears protective clothing and a respirator while testing a bale of straw for presence of methyl bromide with a specially sensitive detector. Lower left—A specially sensitive gas detector is used to test a vacuum fumigation cylinder for presence of methyl bromide after fumigation has been completed. Inset—The Director-General of Agriculture, Mr. E. J. Fawcett, and the Minister of Agriculture, Mr. K. J. Holyoake, at the opening of the Station.

Inset photo. by Photo News.



Plant Quarantine in New Zealand since 1884

By G. A. H. HELSON, Research Superintendent, Horticulture Division, Department of Agriculture, Wellington

THE sole purpose of plant quarantine is to protect agricultural areas against the introduction and establishment of plant pests and diseases from which they are free. Many pests and diseases are more or less specific in their action; that is, they attack only certain groups of related host plants. Therefore, when a cultivated plant is introduced into a country where no near relatives occur, naturally it is likely to be fairly free from serious pests and diseases, the native insects and diseases being in a large measure unable to adapt themselves to such hosts. This desirable condition has not, as a rule, been maintained for any great length of time in any particular locality, for the reason that extensive commerce in nursery stock and other commodities on which pests and diseases may be carried has resulted in the introduction and establishment of many of them.

AS long ago as 1884 the New Zealand Government was aware of this danger of introducing pests and diseases on produce being imported into the Colony. Thus, before the formation of the Department of Agriculture, the Codling Moth Act 1884 had been passed under which the importation of codling moth into the Colony was prohibited. The Act, however, was not alone sufficient to prevent the eventual introduction of this pest, with the consequent recurring annual expense to fruit growers for its control ever since.

Early Quarantine Precautions

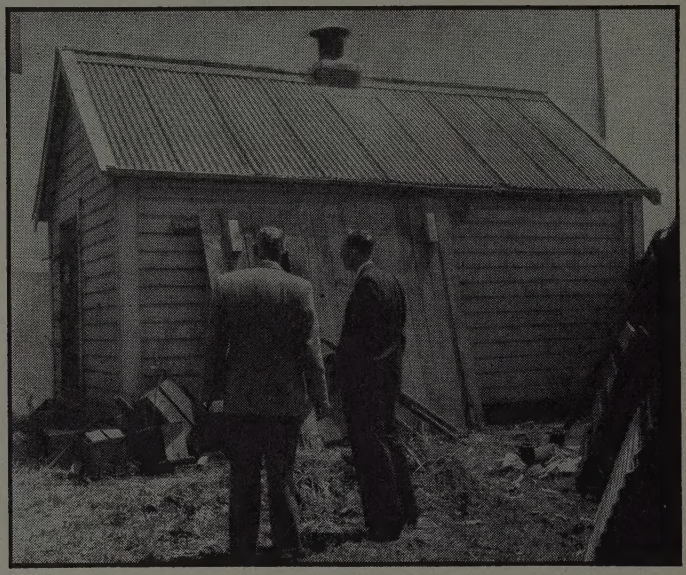
Ever since its inception in 1892 by the amalgamation of the Stock Department and the Agricultural Branch of the Lands and Survey Department the Department of Agriculture has been very conscious of the dangers of introducing harmful pests and diseases of plants and animals. Its first concern was to protect New Zealand's young and growing livestock industry, and it initiated a stock conference which was held in Wellington in October 1892. Delegates from Australia attended and comprehensive quarantine recommendations were drawn up. The wisdom of this early action is now apparent and New Zealand livestock remains to this day free from many of the world's most serious pests and diseases.

In 1893 T. W. Kirk was appointed Acting Biologist and founded the Horticulture Division following many complaints to the Department about insect pests and diseases of plants. His first task was to describe these and their life history and to prepare a number of leaflets on noxious weeds. By 1894 Kirk records that "A quantity of earth-ballast was placed on the reclaimed land; a few months later the heap was observed to be covered with a luxuriant growth of weeds . . ." He drew attention to the constant importation of plant pests and diseases and recommended as a remedy the "prohibition of the importation of all trees, plants, or fruit infected with any insect or fungoid pest".

Again in 1895 he repeated his warning and stressed it by saying:—

> I am now more strongly than ever convinced that the very first step necessary to enable us to combat successfully the ever-increasing army of orchard and crop pests is to prevent the importation of all seed, plants, fruit or other

HEADING PHOTOGRAPH: The great increase in the variety and quantity of products brought to New Zealand by fast transport makes essential the use of modern fumigation equipment such as the vacuum fumigation cylinders in the Plant Quarantine Service's new Station at Wellington. Here products are shown being prepared for fumigation with methyl bromide in one of the cylinders.



This old fumigation building in Wellington, in use from 1899 until recently, is unable to cope with the quantities of material now arriving from overseas and requiring fumigation.

packages infected with any pest or any insect or other organism, whether animal or vegetable, likely to become a pest.

At the present time our ports are open for the introduction of every abomination, with the single exception of codlin-moth, in the shape of weeds, and insect and fungus pests, which any unpatriotic colonist chooses to import—risking, for the sake of a small present profit, the future well-being not of himself only, but also the very existence of important industries and the people dependent thereon.

Kirk maintained that there should be proper supervision at the ports of entry and that all plants and fruit should be carefully examined, and, if diseased, disinfected at the expense of the importer or, if deemed advisable, totally destroyed with all packing. In his annual report for 1895 he set out in detail a proposal for a Proclamation entitled "Importation of Trees and Fruit infected with certain Insect and Fungus Pests Prohibited.—A Proclamation".

He reviewed the Regulations in force in California, British Columbia, and Australia.

Legislation

In 1895 a Bill entitled "An Act to prevent the Introduction and to provide for the Destruction of the Insect known as Phylloxera of Vines" was presented, but though it reached the second reading, time did not permit its consideration by Parliament and the Bill was not passed. The Orchard and Garden Pests Act was passed in 1896. In 1897 proclamations under this Act were gazetted prohibiting the importation of plants and fruits affected by any species of scale insect or by Queensland fruit flies. Vine cuttings infected by phylloxera and fruit attacked by codling moth were also prohibited. Inspection of all fruit and plants arriving in New Zealand was instituted at Auckland, Wellington, Lyttelton, and Dunedin. This was the first serious attempt to prevent the introduction of pests and diseases by an inspection staff centred at the main ports of entry of goods. The first inspectors to be appointed under this Proclamation were: Captain T. Broun, Auckland; W. J. Palmer, Auckland; J. Mayo, Wellington; and J. C. Blackmore, Christchurch. Of this Act Kirk wrote in 1899:—

"The present Act, though giving sufficient power to prevent the introduction of diseased fruit or plants from abroad, yet places absolutely no check on the sale or transit of such if locally grown", and pointed out that fruit infested with codling moth had on several occasions been seen in transit to localities where the insect was then unknown. He was concerned that this was enabling the insect to spread, evidence of which had "been amply verified by the experience of several southern districts during the last three years".

Fumigation Equipment

In 1899 fumigating sheds were erected at Auckland, Wellington, Christchurch, and Dunedin for treating scale infested consignments with hydrocyanic acid gas. Certificates were introduced for fruit from Australia stating that the consignments had been fumigated before export; when fruit arrived without such a certificate and examination revealed scale insects the consignment was fumigated. Thus facilities for the fumigation of imported plant material were not provided until 2 years after the adoption of inspection at the ports of entry. These fumigators have remained in use until the present day.

In 1900 Kirk wrote:—

"The Orchard and Garden Pests Act, 1896", gives power to deal with imported fruit, and so prevent the introduction of more pests, but, with the exception of the dreaded Phylloxera, or vine-louse, takes no notice of pests within the colony, and allows these to be disseminated at the will of any careless or unscrupulous colonist. . . . Unfortunately, the amending Bill introduced again last session did not become law, and codlin-moth-infested fruit may still be seen in transit into and through clean districts. . . .

The 1900 Bill is, with slight modifications, similar to that of last year, and provides a means of compelling dilatory owners, in the interest of their neighbours, to check or eradicate disease from amongst their trees.

Even at this time legislation was proposed to extend the scope of the 1896 Act. However, some Auckland orchardists opposed the Amendment and the Fruit-growers' Union passed a resolution:—

That the union, while expressing gratitude to the Government for taking over an orchard at Henderson for the purpose of experimenting with a view to the destruction of orchard pests, strongly urge that intended legislation be deferred until a specific be found that orchardists can use for controlling the said pests.

Some Nelson growers adopted the same resolution.

An extract from the annual report for 1901 states:—

All imported vegetation, whether fruit or plants, is subjected to the keenest scrutiny, and if any of the proclaimed diseases are present the consignments are dealt with according to law—i.e., fumigated, re-exported, or destroyed, according to the nature of the pest by which the line is attacked. A number of parcels have been destroyed, both at Auckland and Wellington, particularly the latter, on account of the presence of fruit-fly maggots. Surprise has been expressed at the few condemnations for maggot at Auckland, as com-

A Plant Quarantine Service officer examining imported peanuts on the wharf at Wellington.

pared with Wellington. It must, however, be remembered that, though by far the larger bulk of imported fruit enters at Auckland, it is principally from the islands. The greater proportion of Australian fruit, which carries both Queensland and Mediterranean fruit-fly maggots, comes to Wellington. Thus the matter is easily explained.

Thus it is evident that both Queensland and Mediterranean fruit flies were being intercepted in consignments of fruit arriving in New Zealand in 1900.

Fruit inspectors in 1902 were: Auckland, Captain T. Broun, assisted by Mr. G. Harnett; Wellington, Mr. H. Palethorpe; Christchurch, Mr. A. C. Smale; Dunedin, Mr. C. F. Cargill; Bluff, Captain J. W. Raymond, who was also Inspector of Stock.

The regular and systematic inspection of imported vegetation was carefully carried out by these inspectors as required by the "'Orchard and Garden Pests Act 1896'—Imported Fruit, Trees, and Plants".

A circular was issued for general information summarising the various regulations then in force. Briefly these were:—

1. (a) Fruit of any kind infested with fruit flies was prohibited; (b) Fruit infested with codling moth was destroyed or reshipped.

2. Fruit, plants, or trees infested with scale insects were admitted if certified to have been fumigated with hydrocyanic acid gas and the inspector at the port of entry was satisfied that this had been effective.

Any fruit or plants not certified or which were ineffectively fumigated were either fumigated again with the gas or destroyed.

Ports of entry for fruit at this time were defined as including Bluff, Dunedin, Christchurch, Wellington, and Auckland, but only at the last four could fumigation be done. Fruit and plants for Napier and Gisborne could be landed there provided they had been passed at Auckland or Wellington.

Live plants, however, were permitted entry only at Dunedin, Christchurch, Wellington, and Auckland.

Importers were required to arrange for all labour, cartage, etc., in connection with the inspection and treatment of fruit or plants and charges were made for fumigation. Cases (58lb.) of fruit from the southern Pacific islands were charged 3d. per case with a minimum of 2s.; all other fruit was charged 6d. a case (48lb.) with a minimum of 2s. 6d. A parcel of 25 live plants or cuttings cost 6d., with a minimum of 2s.

Mr. Kirk, however, recommended in December 1901 that the charges for fruit from different countries be altered as follows: Cook Islands, 3d. to 1d.; other British islands, from 3d. to 1½d.; foreign islands, to remain at 3d.; Australia and foreign countries, 6d. These were approved by Parliament and the reduced charges came into operation in January 1902. The higher charges for treatment of fruit from Australia, America, and Europe were considered a fine for shipment of fruit without treatment and were intended to secure fumigation at port of departure.

In 1902 most fruit entered the country at Auckland and an inspector and assistant were employed full time on examinations of fruit and fumigation.

Below is a table showing the total number of cases arriving at each port during the 12 months ending March 1902 and published in the annual report of the Department for that year.

Annexation of the Cook Islands made it very doubtful whether inspection of fruit from these islands could be continued, and because the oranges from these islands were frequently infested with scale insects and sometimes fruit fly maggots, it was stressed that unless the Orchard and Garden Pests Bill, or some other measure with similar aims, was at once passed, infected fruit from the Cook Islands would have to be allowed entry to the colony.

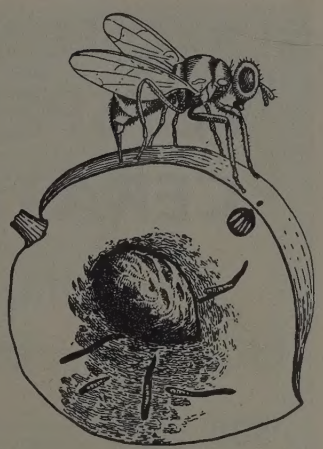
Shipments of Italian lemons and American oranges were reported by Captain Broun to arrive usually in splendid condition, but Mr. Palethorpe reported that American apples received in Wellington brought considerable quantities of codling moth, and only a few lines were passed. The others were shipped out of the colony. No lines of plants and fruit trees were passed without examination even when consisting of only one plant or a bunch of cut flowers. Californian apples landed at Dunedin and Bluff arrived in first class condition and were free from codling moth.

Though the Orchard and Garden Pests Bill was not passed, the following clause was added in 1903 to the Cook and other Islands Government Act Amendment Act:—

> The Governor may from time to time, by Order in Council, prohibit absolutely, or except in accordance with regulations under this Act, the introduction into New Zealand proper from the Cook or other islands of any plant, fruit, fungus, parasite, or any other thing which in his opinion is likely to introduce insect pests or disease.

IMPORTATIONS OF FRUIT AND FRUIT CONDEMNED IN 1902

	Total Imported cases	Fruit Condemned: Scale cases	Fruit Condemned: Codlin-moth cases	Fruit Condemned: Fruit-maggot cases	Total condemned cases
Auckland	224,536	17,154	1,513	2,736	21,403
Wellington	219,095	9,307	584	807	10,698
Christchurch ..	54,291	3,171	80	107	3,358
Dunedin	48,650	824	80	50	954
Bluff	11,011	—	—	—	—
Total	557,583	30,456	2,257	3,700	36,413



[*After Sydney "Sunday Sun"*

The Queensland fruit fly, a serious pest, lays eggs which hatch in a few days in the developing fruit. This fly and the Mediterranean fruit fly were intercepted in consignments of imported fruit as early as 1900, and the Plant Quarantine Service has always been vigilant to prevent their entry.

This Act, however, did not provide any penalty for breach of the law, and regulations, if they had been introduced, could not have been enforced.

Less fruit was imported in 1903, but 950 more cases of fruit were condemned for fruit fly than in 1902. The increase was chiefly at Auckland and was due to the fact that the island fruit was not inspected before shipment. At this time reports indicated that fruit fly was spreading both in Australia and the islands and the strictest possible measures were advised to endeavour to keep it out of New Zealand.

One hundred and seventy-five packages of plants were received from Europe and Australia and many of these consisted of very large cases or bales, some of which contained as many as 250 plants or trees. Some of the larger consignments were condemned and fumigated before delivery. Recommendations included the addition of aphides and ants to the schedule of diseases.

Five hundred and twenty-two packets were examined at Parcels Post and largely consisted of plants reared in America. A few contained vine cuttings and rooted vines and these were burnt as were others infested with scale insects. Shipments of American apples declined after large quantities were condemned because of codling moth in 1902, and quantities of island citrus fell off because of the strictness of the examination on arrival and the amount condemned to be burnt because of fruit fly. Large

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numbers of fruit trees entered through Wellington from Australia, but though they were carefully examined, no trace of scale was found and their condition was generally excellent.

Important Act of 1904

By 1 April 1904 the Orchard and Garden Pests Act, later to become the Orchard and Garden Diseases Act, was consolidated and came into operation on that date. Of this Act Kirk wrote, "It is probably the most important step taken in recent years", and Mr. Boucher, instructor in charge of the greater portion of the North Island, said, "I anticipate a more rapid expansion of the industry than has yet been experienced". Fruit importations again increased in volume and the number of condemned cases increased proportionately. Of the 2046 packages of plants imported in 1904, 39 were condemned. The reports of inspectors showed concern about the risk of introducing fruit fly from Australia and the islands and recommended the strictest measures to prevent its introduction into New Zealand.

Entry of Pests at Wellington

Mr. Palethorpe in his report for 1904 gave a table showing the date on which the various pests were first condemned at Wellington as follows:—

Codling moth

American apples, October 1 1900
Australian apples, December 28 1899
Australian pears, December 28 1899

Fruit-fly maggot

Australian apricots, December 5 1901
Australian mandarins, April 13 1899
Australian nectarines, January 20 1902
Australian oranges, April 27 1899
Australian peaches, January 1899
Australian pears, January 24 1901
Australian persimmons, April 14 1904
Australian tomatoes, December 5 1901
Island bananas, October 7 1901
Island mangoes, December 21 1900
Island maupi fruit, July 12 1902
Island mandarins, April 14 1900
Island shaddocks, May 18 1901

Mealy bug

Australian pineapples, January 25 1900
Island pineapples, December 23 1899

Scale

American apples, October 1 1900
Tasmanian apples, August 20 1900
Australian citrus, September 11 1902
Australian lemons, August 23 1899
Messina lemons, November 23 1899
Island limes, March 15 1902
Australian mandarins, September 18 1899
Australian oranges, August 23 1899
China oranges, January 20 1900
Island oranges, October 17 1899
Messina oranges, December 30 1899
Australian persimmons, April 18 1901

During 1904-05 two Orchard Inspectors were appointed for the North Island and one for the South Island and this enforcement of the Orchard and Garden Pests Act worked a great improvement. Fruit continued to be imported from abroad despite the increase in areas under fruit within the Colony. A new fumigation shed was erected at Auckland during this year, but Kirk stated that "an additional shed four times the size of the present one is needed in Wellington; the inconvenience suffered by importers is excessive".

Experience with Fruit Fly

Pupae of fruit fly found by Captain Broun in the soil accompanying imported plants for the first time showed the necessity for careful examination of all plants. Forty-seven cases of New South Wales apples were destroyed in Wellington because of infestation with fruit fly as well as codling moth.

As evidence of the ability of fruit fly to live in New Zealand Kirk said: "Every year since 1898 numbers have been reared in a plain wire-gauze cage placed on the window-sill of my office in Wellington. The same has been done in Auckland. These flies have paired, and laid eggs in fresh fruit placed in the cage by myself. These eggs hatched, and in turn became full-grown maggots". Experiments were carried out during April and May 1903 to determine whether cool storage of fruit at various temperatures from freezing upward would kill maggots. Oranges were frozen hard and all maggots in infected fruit were dead on removal from cool storage. The freezing did not appear to hurt the ripe fruit, but ruined the unripe.

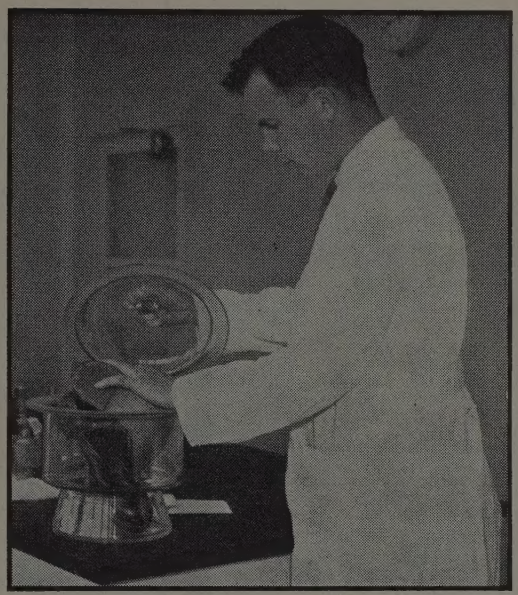
In another experiment the fruit was stored at 32 degrees F. for 3 days. Nearly half the maggots were alive.

Fruit fly maggots were again found in the soil among the roots of plants imported from Australia. In 1905, 24,000 fruit trees were imported from Europe.

Increasing Importations of Fruit

By 1905 the value of imported fruit had greatly increased; in 1904 it amounted to £134,886 and by 1905 it was £156,153. The number of cases of fruit condemned because of fruit fly, however, showed a diminution of 635 cases during the year. American fruit arrived, almost without exception, in splendid condition.

The value of imported fruit had again greatly increased by 1907 and inspection and fumigation were a routine procedure at the ports of entry. For the first time the export of apples was mentioned in the annual report of the Department, arrangements being made to export 600 cases to London by the Motueka Fruit-growers' Company.



A great variety of materials has to be tested by the Plant Quarantine Service. Here boots infested with moth caterpillars are being placed in a desiccator so that the moths can be bred for identification.

Fruit Fly Outbreak

As a result of a relaxation of the regulations a large consignment of fruit containing Mediterranean fruit fly maggots was distributed from Auckland and reached various parts of the Colony. In spite of energetic action, small quantities reached consumers and the infected fruits were naturally thrown away by householders. The result was that later in the season fruit flies were found breeding in peaches in several small gardens at Napier, and in both peaches and tomatoes near Blenheim.

All infested fruit was destroyed and the ground under the trees or where infested tomatoes had grown was several times sprayed with kerosene. Inspection and treatment were so strict that the outbreak was wiped out.

During 1908 fruit flies were found breeding in gardens in Auckland and the same strict measures as were used at Blenheim and Napier were enforced. During this year consignments of plants and fruit trees arrived generally in good condition and none had to be fumigated for scale pests. Most had been fumigated before shipment. During the year the Orchard and Garden Diseases Act was passed.

In 1909 it was reported that there had been no outbreak of fruit fly in any part of the North Island during the preceding season and that careful and thorough inspection of imported fruits at ports of entry, especially with

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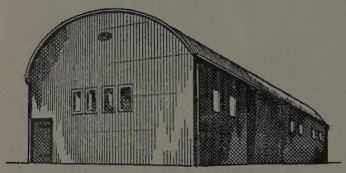

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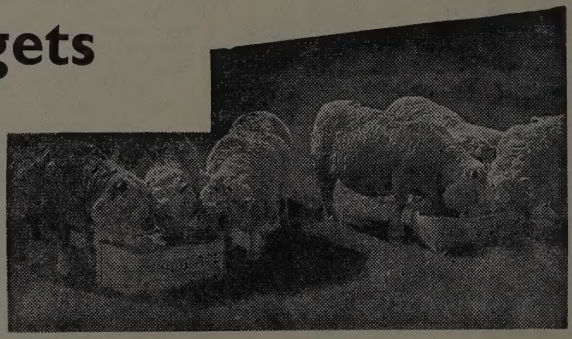

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the assistance of Regulations gazetted in 1908, was effective in protecting the industry. The annual report for 1909, referring to the Orchard and Garden Diseases Act, states: "The great development in orcharding is largely due to the security afforded for the investment of capital by the operation of this Act", and: "There is no doubt that in the near future growing apples for export will be seriously undertaken".

Fruit imported during the year was of better quality and arrived in better condition than previously, and the quantity condemned for fruit fly loss was very small compared with that in the preceding season.

By 1910 the effect of the Orchard and Garden Diseases Act was to decrease the numbers of cases of fruit condemned and shippers were sending to New Zealand only fruit which had been carefully selected. The Cook Islands increased its consignments of fruit to Auckland, but the regulations resulted in very much improved quality. Fumigation facilities were installed in the Cook Islands for the fumigation of fruit before shipment.

In 1911 a much larger number of cases of fruit were destroyed for fruit fly, largely owing to irregularities in shipment from Sydney. However, the rigid destruction of diseased lines and a refusal to examine consignments unaccompanied by official certificates effectually checked this. There was an extraordinary increase in the number of packages of plants imported through Auckland, and fruit trees and plants were reported as arriving clean and free from disease as shippers from other countries became more conversant with the regulations.

By 1913 a large export of New Zealand apples to South America was well established and a better knowledge had been acquired by the commercial growers of the best methods to be adopted for the control of orchard pests and diseases. Many growers acquired up-to-date spraying machinery.

The bean weevil (*Bruchus obtectus*) was intercepted in a line of imported peas in 1914, at which time the weevil was not established in New Zealand. The line was destroyed.

Effect of First World War

Disorganisation of shipping due to the First World War resulted in a decreased export of fruit in 1914-15. The figures of export fruit for 1910 to 1915 were as follows:—

Season	Cases
1910	5,647
1911	6,031
1912	14,869
1913	33,000
1914	67,964
1915	62,164

At this time a great deal of the Orchard Instructors' time was taken up during the export season with the inspection of fruit intended for export. The bulk of fruit shipments arrived from overseas in good condition, but a number of lines had to be fumigated because of scale, mealy bug, etc. It was also found necessary to condemn and destroy a few consignments of oranges infested with fruit fly.

In 1916 a large proportion of the season's importations of Australian fruit trees was found to be infected with root-knot, now known as crown gall. Several consignments were condemned and reshipped and others were destroyed; later, however, condemned consignments were held and allowed to be picked over and non-infected trees were passed.

The big decrease in the quantity of fruit imported during 1918 was attributed to the disorganisation of shipping on account of the First World War. An entomologist, Mr. D. Miller, was added to the Biology Section and began a study of insect and animal indentification. No fruit was exported during 1919 because of the continued effects of the war just ended, but with a large number of new orchards coming into production arrangements were made for regular shipments in 1920. The condemnation of fruit because of fruit fly was confined to only one or two lines and to insect pests hitherto more or less unknown in New Zealand, namely the pear-bud mite (*Contarinia pirí*) and a species of leaf-hopper belonging to the genus *Empoasca*, both of which were extremely destructive. Fireblight (*Erwinia amylovora*) in fruit trees broke out for the first time in the Auckland district toward the end of 1919 and eradication measures under special regulations were begun.

Numerous Interceptions of Pests

In 1920 maize from Fiji was found infested with Angoumois moth (*Sitotroga cerealella*) and weevil and was fumigated. A number of packages of bulbs were found infested with bulb mite and were condemned or destroyed. J. Myers was added to the entomological staff and assisted in a special investigation into the life history of pear leaf-curling midge (*Dasyneura pirí*), which was bad in orchards in the Auckland Province. Methods of control were studied. Two species of maggot flies (*Pollenia stygia* and *Lucilia sericata*) which attacked sheep and their distribution were investigated.

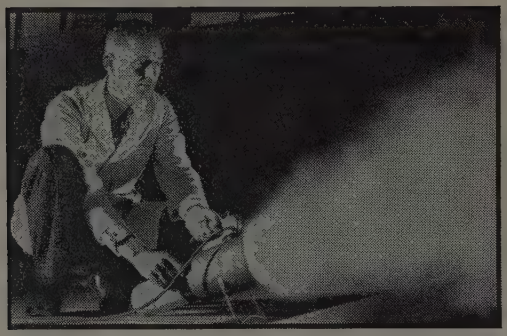
In 1922 the pear leaf-curling midge proved difficult to control. Coconuts from Fiji and Samoa were found to be infested with fruit fly and a number of lines of citrus were condemned for the same reason. Colonies of the woolly aphis parasite (*Aphelinus mali*) were distributed in the main fruit growing areas in 1923 and became firmly established in Hawkes Bay. No lines of fruit were condemned for fruit fly. J. Myers began an investigation into the life history of a cattle pest (*Haemophysalis bispinosa*) in North Auckland, and a survey of the agricultural and horticultural diseases caused by fungi and bacteria was completed by G. Cunningham.

Several consignments of almonds received in 1924 were badly attacked by the Indian meal moth (*Plodia interpunctella*) and had to be reshipped or destroyed. At the time consideration was being given to a scheme of quarantine for imported plants.

In 1925 a new fumigating building was completed at Auckland and is still used for this purpose. Bulb mite infection was again prevalent in imported bulbs and because of this the whole question of bulb importation was reviewed. Recorded in New Zealand for the first time during the year were rust (*Melampsora lini*) on linseed in Canterbury, *Usitilago hypodytes* on *Agropyron repens* in Canterbury and North Otago, and a leaf spot of lucerne (*Pleosphaerulina briosium*) at Ashburton.

Fruit imports from the United States of America increased in 1926-27 because of the removal of the embargo applied to prevent entry of foot and

The Plant Quarantine Service has other duties besides preventing entry into New Zealand of pests and diseases. Here an experimental shipment of pineapples from the Cook Islands is being examined to judge the effects of stem length and packing methods on the keeping qualities of the fruit.



A mechanical fog generator used for fumigating places such as ships' holds, grain stores, and ration stores.

mouth disease. Only one or two other lines were destroyed because of fruit fly. In 1927 regulations were gazetted governing the importation of potatoes into New Zealand to improve the disease situation and the raising of clean "seed". In the same year pear midge parasites became established and showed signs of controlling the midge.

The Introduction of Plants Act 1927 was passed prohibiting the importation of harmful plants (noxious weeds) and new plants into New Zealand. The Seeds Importation Act 1927 regulating the importation of certain agricultural seeds was also passed.

New Legislation

The Orchard and Garden Diseases Act 1928 was passed on 13 September 1928 to consolidate certain Enactments of the General Assembly relating to Orchard and Garden Diseases. Enactments repealed by this Act were the Orchard and Garden Diseases Act 1908, the Orchard and Garden Amendment Act 1914, and the Orchard and Garden Amendment Act 1920. The 1928 Act was later amended by the Orchard and Garden Diseases Amending Acts of 1940 and 1950.

An investigation was begun in 1930 into the effect of dry heat on all stages of the flower and grain moth (*Ephestia kuehniella*) damaging walnuts.

During 1933-34 imports of fruit, especially from Australia, decreased markedly, and imports of oranges and grapefruit from Jamaica were made for the first time. They arrived in good condition.

In 1935 only one line of fruit was treated for fruit fly, but a large quantity of grass seed from New South Wales was fumigated, presumably as a precaution against the entry of cattle tick. Lines of walnut meal arrived infested with the larvae of Indian meal moth in 1935, and also in 1936-37, when a considerable quantity of weevil-infested grain was fumigated.

Additional fruit inspectors were appointed in 1938 to carry out the increased work involved under the New Zealand Grown Fruit Regulations 1938, which came into operation on 28 March. Some consignments of pineapples were fumigated for mealy bug, and seed grain and other items were fumigated for pests of stored products.

By 1940 there was an increase in the quantity of grain, including maize, and grass seed requiring fumigation, especially for grain weevil.

The annual report for 1941 records:—

> Virus diseases appear to be on the increase, and are coming to the forefront as causes of serious loss among horticultural crops. They constitute one of the major problems confronting tomato and strawberry growers, and are also responsible for a reduction in production of cucumbers, marrows, lettuce, and peas. A virus of rhubarb reported for the first time in New Zealand has come under notice in Canterbury, and losses have ranged up to 20 per cent. of the crop in some instances.

The emphasis on inspection about this time appeared to shift to orchard and nursery diseases.

Citrus canker continued to spread at Tauranga in 1942, though prompt eradication measures were reported to have confined it to four orchards. In the Kerikeri district the eradication measures appeared to be successful.

By 1945 no further outbreaks had occurred at Kerikeri and only a few individual diseased trees were recorded from Tauranga. From 1945 to 1949 the position remained unchanged and produce entering the country was largely allowed entry as long as it was accompanied by the necessary certificates and passed examination.

Quarantine Services Considered Inadequate

In 1949, however, a symposium was devoted to the discussion of plant quarantine at the Seventh Pan-Pacific Science Congress held in New Zealand. As a result of this, New Zealand became acutely conscious of the inadequacy of her plant quarantine procedure under modern conditions. Similarly, responsible Governments throughout the world, realising the danger to the agricultural economy of their countries brought about by modern developments, began revising their quarantine regulations to meet the new situation, and in 1951 the International Plant Protection Convention under the auspices of FAO came into operation.

Impact of Fast Transport

Before the Second World War transport of goods to New Zealand took a relatively long time and contact with areas where serious plant pests and diseases were established was made only after a long sea voyage. Despite this many pests and diseases did succeed in becoming established in the country during the pioneering days and the early years of this century. To name but one of these with which all are familiar, the codling moth in apples was here before 1884. In the last decade, however, a revolution in transportation has taken place, for not only has surface transportation become faster, but this period has ushered in air transport, so that today the time taken to cover distances between far points of the globe has been reduced to hours only. Such speed of transport now makes it possible for pests and diseases from which the country was formerly protected by the time taken to get here to find their way into New Zealand on living material and also as stowaways, especially in aircraft, and in many instances dissociated from their hosts. So it has come about that the barrier of isolation has broken down and primary producing industries are exposed to new dangers which could seriously affect production at a time when it has been estimated that it must expand at the average rate of 2½ per cent. a year over the next quarter of a century if New Zealand is to meet the requirements of an expanding population and maintain her exports of primary products.

Many Pests and Diseases Kept out

Though many pests and diseases have succeeded in the past in becoming established here, there are a great many serious ones in countries with which New Zealand trades which are not present here. A few of these are the oriental fruit fly and other serious fruit flies, the giant African snail, the Colorado potato beetle, the golden eelworm, wart disease and ring rot of potatoes, many virus diseases of fruit trees and field crops, foot and mouth disease, swine fever, and rinderpest of stock. Recently a living brown snake was intercepted in bulk wheat which arrived at Timaru from Australia. If any of these pests or diseases were to become established here, production would be seriously affected, and establishment of some of them, foot and mouth disease, for example, would be a national disaster.

Restrictions imposed by plant quarantine are based on the premise that economically it is better to undergo some inconvenience and initial expense to exclude a pest or disease than to have to attempt to eradicate it or at best to control it for an indefinite period, as has been necessary with codling moth.

Plant Quarantine Measures

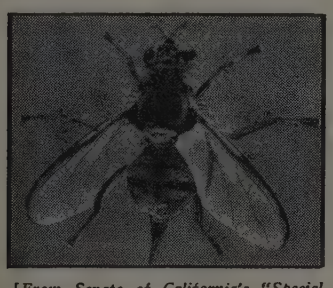
Efficient and well equipped animal quarantine stations protect New Zealand's animal industry. On the other hand control of plant diseases has depended entirely on very small fumigation sheds erected in 1899 and incapable of handling the quantities of plant

material and goods now being imported into this country. Ideally, of course, to prevent further importations of disease the importation of all plant material which could carry new pests and diseases should be excluded, but as this is an ideal which today is quite impracticable, plant quarantine must be a compromise between total exclusion and completely free admission of goods. Some materials, because of the extreme hazards associated with them, cannot be permitted entry; examples are oranges from areas with oriental fruit fly and soil from anywhere. With other commodities such as wheat for milling and dried fruit or rice for consumption there may be little risk.

The whole aim of quarantine must be to provide, with the least possible restriction to trade, sufficient safeguards against the introduction of pests and diseases and the export of infected material. Thus where materials that may contain unrecorded pests have to be imported, fumigation (or other treatment) must be used as a safeguard whenever this course seems prudent. Conversely it is necessary to fumigate some commodities which are exported, such as some flower bulbs sent to Australia, to comply with the requirements of that country.

New Quarantine Equipment

The Government became acutely conscious of the inadequacy of New Zealand's plant quarantine procedure under modern conditions and the inadequacy of its fumigation facilities in 1949. Since then the existing laws and regulations have been amended and immediate plans were set in hand to erect the most up-to-date quarantine stations possible in Wellington, Auckland, Christchurch, and Dunedin. The first of these to be completed is that in Wellington and consists of an atmospheric chamber and two large vacuum cylinders, where plants, seeds, and other produce can be fumigated at ordinary or reduced pressures with methyl bromide for the control of plant pests or with formaldehyde for the prevention of such animal diseases as foot and mouth disease. Ability to treat imported material in this way enables trade to be opened up with areas from which hitherto it has not been safe to import materials. This is most important, as it helps to remove restrictions and free international trade. Thus there is in this station a small, fully equipped refrigerated cool store.



[*From Senate of California's "Special Report on the Control of Oriental Fruit Fly in the Hawaiian Islands"*

The oriental fruit fly is one of the many serious pests which have been prevented from entering New Zealand by the vigilance of the Plant Quarantine Service.

[*Photo News*

Indicative of the interests served by the Plant Quarantine Service and the commercial and scientific bodies concerned in its operation is this group at the official opening ceremony of the new fumigation station at Wellington. Left to right—The Minister of Agriculture, Mr. Holyoake, his private secretary, Mr. R. D. Steel, the merchandise manager of the New Zealand Loan and Mercantile Agency Co. Ltd., Mr. V. C. McPhail, and the Director of the Entomological Research Station of the Department of Scientific and Industrial Research, Dr. D. Miller.

Cool Storage Investigation

Study of the effect of cool storage on the Natal fruit fly proved that in oranges all stages of the fly can be killed by storing the fruit at a temperature of 31 degrees F., plus or minus one degree, for 21 continuous days. As a result of this study trade with South Africa has been begun and today New Zealand has another source of supply and imports considerable quantities of South African oranges. Previously it was not considered safe to import oranges from South Africa, because no satisfactory control of the fruit fly was known. Similarly it is hoped to open up trade with Spain and in November 1954 a trial shipment of Spanish grapes packed in barrels was imported under the same stringent conditions of in-transit cool storage which is effective for the control of Mediterranean fruit fly. This is the first time Spanish grapes have been imported, and the shipment was made possible by the study of quarantine techniques, so making it safe to import under stringent cool storage. Studies on methods of fumigation and quarantine techniques seeking to open up trade with other parts of the world are being made in the station's well equipped laboratory staffed by qualified scientific personnel.

In this way and by providing these up-to-date stations and amending the law New Zealand is protecting her primary industries and honouring her obligations under the International Plant Protection Convention 1951. In addition there is now a fully trained and qualified staff of 20 Plant Quarantine officers responsible for meeting all overseas vessels and aircraft arriving in New Zealand. The Plant Quarantine Service is also used as a training ground for plant quarantine officers of the various Pacific Islands such as Samoa, Cook Islands, Niue, Tonga, and Fiji. These officers are trained in methods of methyl bromide fumigation, wharf and aircraft inspection procedure, and New Zealand plant quarantine methods. After training they return to their own countries able to conduct plant quarantine and able to instruct others.

Co-operation Needed

To be successful plant quarantine requires the fullest public support and the co-operation of every traveller and importer. Importers, whether commercial or private, can assist by making sure that every consignment of plant material is accompanied by a health certificate and that the nearest Plant Quarantine Officer of the Department of Agriculture is notified in advance of the arrival of highly perishable material such as bud wood so that it may be received, treated, and dispatched as quickly as practicable. By acquainting themselves with the regulations before importing plant material importers can avoid unnecessary disappointments and delays, and if any doubts exist as to the best steps to be taken to facilitate delivery of material, the Department of Agriculture should be consulted.

With the exception of the upper illustration on page 116 and those otherwise acknowledged all photographs are by National Publicity.

Care of Livestock during March

Contributed by the Animal Research Division

BLOWFLY STRIKE IN SHEEP

BLOWFLY strike is likely to occur in showery autumn weather when the humid conditions do not allow rapid drying of the fleece. Constant supervision is necessary to ensure that all cases are treated in the early stages. The wool should be sheared so as to leave a clean margin all round the strike, and a careful watch should be kept for narrow tracks leading to areas some distance from the original strike. The affected sheep should be treated with a good non-irritant dressing and the maggots should be collected and destroyed, as if they are allowed to fall to the ground, they are capable of hatching into flies. Jetting with preparations containing D.D.T. or B.H.C. will protect sheep against blowfly strike for several weeks.

PULPY KIDNEY VACCINATION OF EWES

If losses from pulpy kidney are usually experienced in lambs under 6 weeks of age, they can be prevented only by the ewes being vaccinated. If ewes have not been vaccinated in previous years, the first dose should be injected when they are crutched before tupping and another dose should be injected just before lambing. Ewes which have been vaccinated in previous years require only the pre-lambing injection. Vaccination should be done in temporary yards. Syringes should be boiled before use and needles should be kept in methylated spirit and wiped and changed each time the syringe is filled. Vaccination of ewes will not be effective in preventing losses in lambs over 6 weeks of age. Where such losses occur it is necessary to vaccinate the lambs themselves.

FEED HAY TO CALVES

Calves should have access to good hay at all times. It is particularly valuable after the first autumn rains, and will greatly assist in preventing the severe scouring which sometimes occurs after the grazing of lush, rapidly growing pasture. Calves must be rotated through the paddocks at intervals of a few days. Set stocking at this time of year is bound to result in scouring, unthriftiness, and some deaths.

LENGTH OF LACTATION PERIOD

If dairy cows are well fed, they do not need more than 60 days' rest between lactations. New Zealand Dairy Board statistics show that the average length of lactation in New Zealand is only 248 days. Production could be materially increased by milking cows longer. A good rule is to continue milking a cow while she is giving more than 10lb. of fat per month, unless she is within 60 days of calving.

CULLING OF EMPTY COWS

A cow should never be culled for sterility without being examined for pregnancy by a veterinary surgeon. Many cows thought to be empty have proved to be in calf when slaughtered at the works. Presence or absence of heat is not an infallible guide in diagnosing pregnancy. Good producers which are empty may be worth keeping, as about 80 per cent. of such cows hold when mated in the following season.

LEAD POISONING IN CATTLE

Many cattle die from lead poisoning each year. Common sources of lead on the farm are old paint tins, discarded scraps of metallic lead, and old batteries. These should be buried or disposed of in such a way as to prevent cattle from having access to them. Calves frequently suffer from lead poisoning through licking painted surfaces, and care should be taken to prevent their doing this.

Short-rotation ryegrass can be shut up during autumn for grazing by ewes for 3 weeks before lambing to prevent an outbreak of sleepy sickness.

SLEEPY SICKNESS IN EWES

Sleepy sickness, which in some seasons causes severe losses in pregnant ewes, is due to a sudden drop in the food supply just before lambing. On many farms the only feasible way of avoiding this is by shutting up pasture in autumn for grazing by the ewes for 3 weeks before lambing. Short-rotation ryegrass is particularly valuable for this purpose, as it continues to grow during winter, even in Southland.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during December and for the 5 months ended 31 December 1954, with comparative figures for the same month and 5-monthly period of 1953, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

Period	Creamery (tons)	Whey (tons)	Total (tons)	Percentage Inc. or dec.
December 1954	22,038	428	22,466	—
December 1953	22,739	446	23,185	—
Increase or decrease ..	—701	—18	—719	—3.101
5 months ended 31/12/54	92,952	1,697	94,649	—
5 months ended 31/12/53	91,843	1,714	93,557	—
Increase or decrease ..	+1,109	—17	+1,092	+1.167

Butter in store at 31 December 1954 was 27,023 tons

CHEESE

Period	White (tons)	Coloured (tons)	Total (tons)	Percentage Inc. or dec.
December 1954	12,068	3,698	15,766	—
December 1953	16,377	30	16,407	—
Increase or decrease ..	—4,309	+3,668	—641	—3.907
5 months ended 31/12/54	42,875	12,056	54,931	—
5 months ended 31/12/53	52,328	59	52,387	—
Increase or decrease ..	—9,453	+11,997	+2,544	+4.856

Cheese in store at 31 December 1954 was 24,728 tons

If these figures are converted into butterfat equivalent, there is an increase of 1.910 per cent. in butterfat graded for the 5 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time they are not necessarily a true indication of production trends.

Pasture Management in Autumn

Seasonal Notes by the Extension Division

MOST pasture management practices require a planning or preparatory phase before being put into operation, and autumn and early winter pasture management should be planned now.

AUTUMN AND WINTER MANAGEMENT

CONSIDERATION should be given to the improvement of worn-out pastures by resowing or oversowing, the fertiliser and lime requirements of all fields selected for autumn topdressing, and the details of a grazing and supplementary feeding programme to allow fields for winter-saved pasture to be closed at suitable times and in suitable condition. Fields to be improved by oversowing should be well surface cultivated, and this is most efficiently done immediately after the first autumn rains while the soil is moist and the surface bare of vegetation. Soil tests may be required to determine the fertiliser and lime requirements of certain fields, and information on fertility status should be obtained early enough to allow topdressing to be done at the appropriate time. On dairy farms the aim should be to close about 40 per cent. or more of the farm for winter-saved grass. It is best to plan in anticipation of a poor winter and early spring grass growth and start closing early. If grass growth is good, early closed fields should be quickly and lightly grazed and closed again, but if growth is poor, late closed fields will make little or no contribution to late winter or early spring feed supplies. In cold climates where autumn grass growth cannot be relied on cereals for greenfeed should be sown in well-prepared seed-beds early enough to produce a reasonable supply of winter feed.

—J. E. BELL

* * *

TOPDRESSING

TOPDRESSING is applied to intensively managed pastures not only to increase the total yearly production but also to encourage pasture growth at times of the year when it is at a minimum, namely in winter and early spring. Therefore, the common practice of autumn topdressing is carried out mainly to encourage winter and early spring production. Autumn topdressing of phosphatic and potassic fertiliser should be applied at the optimum time. It should not be applied so early that it lies for long periods unused on the dry and hard surface and may burn the sward or so late that the cold weather inhibits pasture growth. On dairy farms 3cwt. per acre of phosphatic fertiliser is usually sown. Where topdressing is done twice yearly 2cwt. per acre is recommended for each application. Where both fast and slow acting phosphates are sown twice yearly on the one farm the sowing of the faster acting phosphate in autumn is recommended. On new and partially developed areas, particularly scrub land areas, up to 4cwt. per acre should be applied in autumn. On potash deficient areas at least 1cwt. per acre of potash should be applied initially. Thereafter yearly maintenance dressings from ½cwt. to 1cwt. per acre should be applied, depending on the farm management practices and the soil type.

—N. A. CLARKE

* * *

SOIL TESTING

FERTILISER and lime requirements for topdressing depend on soil type and past topdressing and pasture management. Previously advice on topdressing was based on a general knowledge of soil type requirements, topdressing history of the field under review, and sward appearance. On many farms topdressing has been done over a very long period and information on this and also on past pasture management is often lacking. Also in some instances an instructor may not have sufficient information on the fertiliser and lime requirements of a soil type as found in a particular field, for innumerable small variations of soils exist and are not recognised as separate soil types, but they may have important effects on fertility status. To provide an additional advisory guide to farmers and instructors the Extension Division of the Department of Agriculture has recently established a soil testing service which supplies information on the lime, phosphate, and potash status of soils. The data provided by the soil tests must be carefully interpreted and considered in relation to the other guiding factors already mentioned. The fees charged for the service are £1 per sample for the first four samples and 10s. for each additional sample. Farmers wishing to make use of the soil testing service should make application to their local Instructor in Agriculture.

PASTURE MANAGEMENT ON FAT LAMB FARMS

The saving of pasture growth on North Island fat lamb farms for late winter and early spring feeding should be arranged on somewhat similar lines to that carried out on dairy farms, but with due regard to height of feed. Grazing should be concentrated on part of the farm to allow feed to come away on the remainder. After tupping, the ewes should be rotationally grazed in one or two large mobs and done hard for 2 months, the aim being to save as much feed as possible for use about lambing time. Paddocks strong in ryegrass should be shut up and should be lightly grazed with cattle if they become too rank. As lambing approaches, the ewes should be allowed on to the saved grass for 2 to 3 hours or longer per day according to the feed supply available, and after lambing the ewes and lambs are usually set stocked.

—J. D. J. SCOTT

* * *

PASTURE MANAGEMENT ON HILL COUNTRY

AUTUMN management on North Island hill country calls for ready adjustments to conform to the season being experienced rather than a routine sequence of events. Dry weather may bring lack of water and feed and in some seasons the risk of eczema, which will necessitate careful attention to grazing management at critical periods. If the weather is wet, the extra growth of fern and grass necessitates frequent concentration of cattle, and this means that farms should be well subdivided with good fences. Ewes previously done fairly hard in the summer so that they are fit, lively, and not too fat should be provided with extra good fresh grazing 2 to 3 weeks before mating to increase twinning. Special crops or pastures should be used to provide this feed. Fields should also be set aside to provide mature grass for hoggets in the critical autumn months. Other fields should be set aside to bridge the short and sometimes severe gap between late autumn and early spring, a method adopted by dairy farmers. This feed will prove invaluable for wintering run cattle. Withdrawing a few paddocks from the rotation after the rams have been taken out in May and doing the ewes hard over June-July causes little harm to the flock. Where possible a crop of swedes or chou moellier for mid-July-August feeding will spell the farm and allow grass to come away, providing essential growth 2 weeks before and over the the lambing period.

—H. McM. BULL

Honey House Construction and Layout of Plant

PLANS are prepared in this article by L. H. Johnson, Apiary Instructor, Department of Agriculture, Palmerston North, of a 2-storied honey house which is adapted for building on a section with a steep slope and somewhat restricted in area. Sufficient scope is needed, however, so that roads can be made to give vehicular access to the upper and lower levels of the building. In issues of the "Journal of Agriculture" for May, June, and July 1954 the same author gave plans of several types of honey houses, all of which were designed for building on a level or slightly sloping section.

IN nearly every instance a plan of building must be prepared for each site under consideration because of the direction of approach and the slope of the ground. For this reason it may not always be possible to use a stock or standard plan.

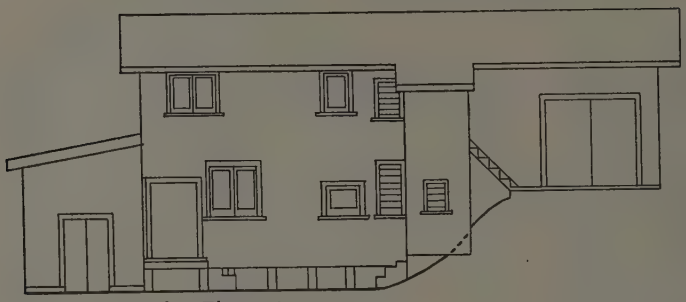
Building Principles

A perusal of the plan will give an idea of what is involved and the arrangement of plant, which will be similar in most 2-storied structures.

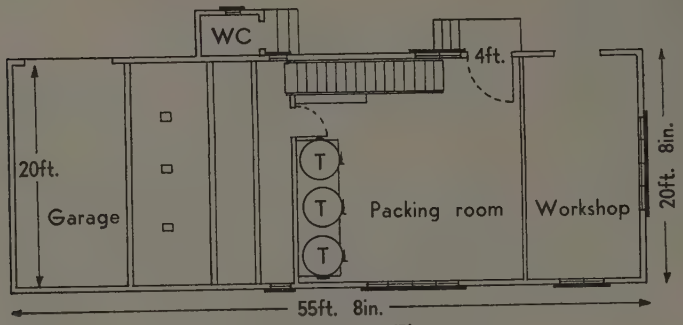
Piles must have a minimum sectional area not less than 100 sq. in. and heavier timbers are required for certain studs, trimmers, and ceiling joists than for a single-storied building.

The honey extracting plant is usually designed to operate on the gravity principle.

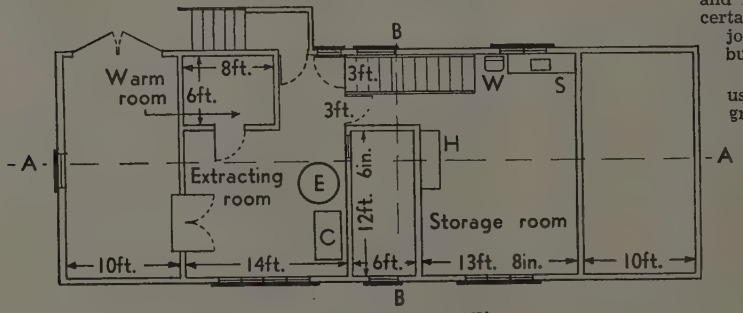
Plan No. 7 of Honey House



Side Elevation

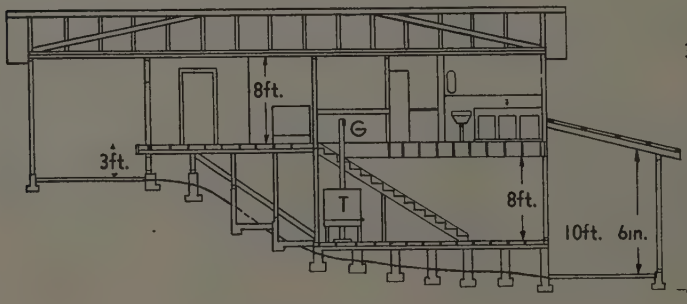


Plan of Lower Floor

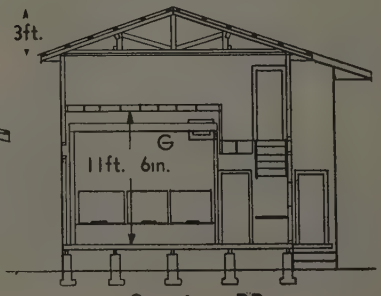


Plan of Top Floor

C Cappings reducer
E Extractor
G Gantry
H Hats and coats
S Sink bench
T Tanks
W Wash hand basin



Section AA



Section BB

One of the very bad features of a 2-storied honey house is that any honey or water spilt on the top floor may seep through and damage stored goods or utensils on the lower floor. Besides causing very unsightly stains on the ceiling of the lower story it is unhygienic.

Water cannot be used freely for washing floors. The plan and materials to use are designed to overcome this defect.

PLAN NO. 7

Plan No. 7 shows a building on the edge of a bank where advantage can be taken of the two levels of the ground. Should a preliminary survey of a selected site show a difference of approximately 9ft. between the two levels of the ground, it will be about right.

Foundation

To determine the levels of the building the initial move is to fix a point for the top floor at 3ft. above that of the garage. This can then be taken as datum and the deductions for setting the foundation may be made accordingly.

Any adjustment to the ground at the loading-out platform can be attended to later.

It is better not to make any extensive excavation but to work to the contour of the ground as much as possible and to avoid building a concrete retaining wall for the full height of the first story.

Concrete piles with 10in. x 10in. bases should support the structure without settlement on most soil types provided they are spaced at 3ft. centres and 4ft. between the rows. The maximum air flow under the floor is thus obtained.

Each row of piles on the sloping ground has a sleeper plate bolted on top with 4in. x 3in. short studs to support the floor joists of part of the main floor.

Two-way diagonal bracing is necessary.

Specification

Sizes of timber and other materials to use are:—

Sleepers, 4in. x 3in. heart timber.

Joists, 5in. x 2in. heart timber.

Bottom plates, 4in. x 2in. heart timber.

Foundation studs, 4in. x 3in. heart timber.

Bottom story opening studs, 4in. x 3in. timber.

Studs, plates, dwangs, braces, ceiling joists, rafters, trimmers, and runners, 4in. x 2in. timber.

Bearing trimmers, 6in. x 4in. timber.

Second story floor joists, 12in. x 2in. timber.

Collar ties, 6in. x 1in. timber.

Purlins, 3in. x 2in. timber.

Flooring, 6in. x 1in. t. and g. heart or preserved timber.

Bevelled back weatherboarding, 6in. x 1in. heart or preserved timber.

Spout facing and barge boards, 8in. x 1in. heart or preserved timber.

Stair strings inside, 10in. x 2in. (outside 8in. x 1in.) heart or preserved timber.

Soffit. Asbestos cement.

Interior wall covering, vertical matchlining (timber), hard board, fibrous plaster, plaster core board, asbestos cement, or woodpulp soft board.

Skirting, 4in. x 1in.

Architraves, 3in. x 1in.

Ceilings, woodpulp soft board.

Windows, two-, three-, and four-light casement windows with sashes 40in. x 22in. and one 22in. x 36in.

Glass louvres, two at 4ft. 6in. x 2ft. One at 3ft. x 2ft. One 2ft. x 1ft. 6in.

Roof covering, wire netting, impregnated building paper, and corrugated iron.

Lower Story

The lower story includes a honey packing room, cool-draught storage space, and a workshop at ground level. The walls and ceiling of the packing room are lined. On the one wall, as shown on the plan, is a four-light casement window and on the opposite wall a two-light window. The sill height taken on the inside should be 3ft. 6in. from the floor.

A stair with a clear runway at the bottom and top will give access to the top floor. It is necessary to fix in place a hand rail. An exit door and loading-out platform are built at the foot of the stair. The honey tank stand measuring 3ft. wide by 12ft. long and 1ft. 10in. high, will take three tanks, each with a capacity of 1 ton.

The ceiling above the tanks is 11ft. 6in. from the floor. There are three reasons for this.

1. The operator standing on the top floor may view the level of honey in the tanks through a small window in the partition or by opening the door at the head of the stairs.

2. There can be no seepage of water or honey from a floor above to fall into the tanks.

3. Adequate space will permit the erection of a gantry with block and tackle to haul the honey stirrer out of one tank to move it to another.

A window with a sash 1ft. 6in. high by 2ft. 6in. wide fixed in the wall above the plate line on the opposite side to the stair will throw light on to the gantry and down into the tanks.

Cool Air for Storage

The space under the extracting room floor may well be utilised for the storage of freshly packed honey in a draught-cooled atmosphere. When the surface of the ground is being prepared the less excavating that can be done the better, as there is not so much danger from water seepage. The ground must be dry to make a good storage place. The floor may be stepped up between the piles and concreted. A glass louvre 4ft. 6in. high by 2ft. wide with obscure glass should be fixed to each side wall. A door between the stair and honey tank will give access to this storage space. With sunlight excluded and abundant draught passing through, this storage space will be the coolest place in the building.

Several tons of packed honey may be stored here and carried through well into the following summer.

Workshop

At the end of the building is a suitable place to build a workshop with an outside entrance at ground level. The foundation should be of concrete with continuous walls and the floor of the same material 3in. thick. So that a story can be added in the future, studs, window, and door trimmers should be the same as for the lower story.

Garage

The garage is built on the higher ground level in front of the top floor, the walls and roof being in line with the main building. It is designed for backing a motor-truck into the garage for unloading off the side. If it was desirable to drive forward into the unloading stage, the doors could then be built at the opposite end of the garage. Whether the choice is to drive in forward or reverse gear the important point is to see that the landing stage is on the same side as the driver. If it is on the blind side, a little error in driving judgment may cause damage to the truck or building. The positions of the doors and the warm room and the design of the whole interior of the building are governed by the loading-in arrangement.

Main Floor

To make use of one of the many types of honey house bogies or hand-trucks for moving tiers of honey supers the main floor should be at approximately the same height as a motor-truck. To compensate for some variation in a loaded or unloaded truck a runway may be placed between the truck and floor.

Extracting Room

With the extracting room the first consideration is to make the floor watertight so that honey containers stored below will not be spoilt.

There are two methods which should be practical. They are:—

1. One-ply tarred roofing material may be laid over the joists. Laps should be over a joist and the edges of the fabric should be turned up 3in. at the walls, after which the flooring may be laid.

2. After the floor has been laid a bevelled strip of timber should be fixed to the floor next to the wall. Then an inlaid linoleum may be glued

with waterproof cement to the floor. The outer edges should be turned up over the bevelled strips around the walls, with the exception of the doorways. It is not good honey house practice to use a hose on a floor. Care should always be exercised to avoid spilling honey or water on the floor. All supers with combs of honey should be set on metal trays and the floor systematically cleaned up at the end of each day's work. This is practical and though it has been stressed before, it is felt that it needs emphasis.

Warm Room

As most beekeepers find a warm room to be a valuable aid to extracting, it may be included in the standard equipment.

The method of insulation inside the timber framing is simply to build in two complete envelopes of woodpulp soft board without any connecting metal that would conduct heat to the outside.

Adequate Light

On one wall is a four-light casement window and on the opposite side an opening glass louvre.

Access

Outside access is provided by a side door and porch with steps leading to the ground on the higher level.

The stair and the passage to the storage room may be closed off by doors.

Gravity System

The minimum of extracting equipment is shown. Honey from the extractor and melter should run into a container and then by a pipe through the wall to the tanks below. There is ample room above the tanks to install any one of the efficient types of honey strainers. Honey leaving a strainer should be baffled and led to the side, as this will cause fewer air bubbles to be incorporated in the honey.

Should it be necessary to reliquefy honey that has granulated in bulk containers, the containers may be loaded on to a motor-truck at the exit door and transported to the extracting floor on top. The gravity system may then be used again.

Storage Room

The storage room is an unlined room. As the main floor does not carry through above the stairs or honey tanks, a 3ft. wide catwalk is built at the floor line between this room and the extracting room.

A single-light window shown on the side elevation will shed light on the stair. The ceiling above the tanks should be decked over and the space up to the roof may be profitably utilised for the storage of clean, light materials such as empty honey containers.

The store room may be a suitable place in which to build in a wardrobe.

Beekeepers must provide among other facilities a wash hand basin together with a sufficient supply of soap, hot and cold water, and clean towels. A suitable place for a wash hand basin is on the outer wall above part of the stairs. There is also space on the same wall to set up a sink bench with cupboards. Though this may not be essential, it is desirable. Numerous small utensils must be washed up daily during the honey extracting and packing season.

Should the honey house be at some distance from the dwelling, these facilities would be ideal for the provision of morning and afternoon refreshments.

A small office for keeping accounts may be tucked under the stair. Adequate daylight is obtained from a single-light window.

Privy accommodation: To utilise all the space available privy accommodation may be provided on the ground floor below the porch.

Electrical work: Electric lights and power points are to be installed in each room.

Painting: All outside woodwork should be primed and given two coats of paint. Interior walls and the ceiling of the extracting and packing rooms should be painted with two coats of water resisting paint. Some of the near-white plastic paints appear to be ideal.

Should a beekeeper take the general idea from this plan, but wish to make some alteration to suit himself, he should not do so without carefully considering every detail, as any change could upset the whole balance of design. Every beekeeper contemplating building is advised to obtain a copy of the Food Hygiene Regulations, serial No. 1952/74.

Those clauses applicable to honey houses may be found beginning with Part III 19 to 23 and Part IV 27 to 31 inclusive.

Should he intend to erect the building himself, he would do well to obtain a copy of the New Zealand Standard Code of Building By-laws Part IX, light timber construction, obtainable from the New Zealand Standards Institute for 2s. 6d.

There are some honey houses which require reconditioning, but for those who plan to erect new buildings, a structure is needed that will comply with building by-laws and health hygienic regulations and in which an average crop of honey may be efficiently handled within the minimum of floor space.

Many beekeepers have set and maintained a very high standard of efficiency and cleanliness, but those still behind should work to a yearly plan of improvement. In every instance whether the honey house is old or new a high standard of cleanliness is desirable.

Radio Broadcasts

THE following radio broadcasts to farmers will be given during March:—

1XH Hamilton

14 March (12.33 p.m.)—"Preparation for the Poultry Breeding Season", by W. L. Jourdain, Poultry Instructor, Department of Agriculture, Hamilton.

21 March (12.33 p.m.)—"Off-season Improvements in and around the Milking Shed", by E. P. Carter, Special Inspector, Department of Agriculture, Hamilton.

25 March (8.10 p.m.)—"Current Farming Problems", panel of speakers.

28 March (12.33 p.m.)—"Review of Meat Marketing under Free Trade", by H. Wagstaff, Federated Farmers, Hamilton.

1YZ Rotorua, 7.15 p.m.

3 March—"Poisoning in Stock", by D. W. Caldwell, Veterinarian, Department of Agriculture, Hamilton.

17 March—"Pasture Improvement", by A. V. Allo, Instructor in Agriculture, Department of Agriculture, Tauranga.

23 March—"Sidelights on Present Day English Pig Farming", by S. W. Rees, Supervisor, Bay of Plenty District Pig Council.

31 March—"Off-season Improvements in and around the Milking Shed", by E. P. Carter, Special Inspector, Department of Agriculture, Hamilton.

3YA Christchurch, 12.20 p.m.

7 March—"Choosing and Using Household Equipment", by E. Couston, Field Officer in Rural Sociology, Department of Agriculture, Christchurch.

28 March—"Preventing Dipping Losses", by J. Gibson, Livestock Instructor, Department of Agriculture, Christchurch.

Regular Sessions

1XH Hamilton, Mondays at 12.33 p.m. and Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8.5 p.m., Wednesdays at 8.1 p.m. (Northland stock market report), Fridays at 8.1 p.m.

1YA Auckland, Mondays, Tuesdays, Wednesdays, Thursdays, Fridays, 7.45 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7.15 p.m. (Pig Council talk on fourth Wednesday of every other month), Thursdays at 12.33 p.m. and 7.15 p.m. fortnightly).

2XA Wanganui, Wednesdays at 8 p.m. (Wanganui stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawkes Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawkes Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Mondays at 8 p.m. (Pleasant Point stock market report), Tuesdays (fortnightly) at 8 p.m. (Temuka stock market report), Wednesdays at 8 p.m., and Saturdays at 10.30 a.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Thursdays at 12.33 p.m.

4YA Dunedin, Mondays at 12.33 p.m., Wednesdays at 7 p.m. (Burnside stock market report), Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 7 p.m.

Choice and Purchase of Near-to-lay Pullets for Household Flocks

By H. H. WATSON, Poultry Instructor, Department of Agriculture, Wellington

WITH the completion of the building of the fowl house for 8 birds described in the January issue of the "Journal", the householder will need to consider the purchase of suitable birds. Birds should be ordered early in the hatching season; otherwise one may be disappointed by not getting suitable stock. It is advisable to have birds coming into lay during February or March. Birds should be purchased near to the point of production, thus ensuring that they will begin laying within 2 to 3 weeks from time of delivery.

CHICKS hatched during September will now be near the point of production and will lay satisfactorily throughout the season. The purchase of late-hatched pullets (those hatched in late October to December) is not recommended, as it may be weeks or even months before these birds begin producing. The object of the householder keeping a few birds is to have fresh eggs, particularly when their price is at its highest.

Choice of Breed

In the choice of breed to keep one should be guided by the popular breeds kept by commercial poultry farmers. The breeds most popular in New Zealand are the White Leghorn, Australorp, and Rhode Island Red. The White Leghorn is classed as a light breed and the other two are classed as heavy breeds. It is a common practice among commercial breeders to cross the breeds mentioned and the progeny from these crosses can be entirely satisfactory for the householder.

A popular cross is from the mating of White Leghorn male and Australorp female or Australorp male and White Leghorn female. These crosses are usually referred to as Austral-Whites. Another satisfactory cross is the White Leghorn mated to the Rhode Island Red. Heavy breed birds, including the crosses, are larger than those of light breeds and differ from the latter in their tendency to become broody or clucky. Certain strains of heavy breeds are more prone to broodiness than are others and many commercial breeders are trying to reduce broodiness by identifying their broody birds during the laying season and excluding the obvious ones from their breeding flocks.

Australorps are the only serious competitors to Leghorns for popularity in New Zealand.

[*Niederer*

An excellent type of White Leghorn pullet 7 months old and in lay.

The light breeds show little or no broodiness and for this reason alone are sometimes preferred as a breed by householders. However, consideration must be given to the better winter egg production of the heavy breeds and to the fact that these birds are better for table purposes. Food and water should be given to the bird when she is in the broody coop.

The extra eggs returned during winter from heavy breeds are far more valuable, as at that period eggs are at their peak price and also in short supply. Broodiness usually appears during spring and this complaint can be controlled by placing a broody bird in a coop immediately she is noticed. The bird should be left in the coop for 48 hours, but after this can be returned to the flock. Provided that a broody bird is caged shortly after becoming broody, she may continue laying. Often a particular bird will appear broody on several occasions and should the bird go out of production she should be used for table purposes.

Health and Constitution

In addition to good laying ability an important point is the health and constitution of a flock. The over-all egg-laying average of a flock during a season can be lowered if birds become sick and die. However, during a season one could expect to lose an average of one bird from the eight layers that were housed originally.

It is advisable to purchase stock from a reputable poultry breeder, and a personal visit to the farm will allow the purchaser to see the stock and the conditions on the farm. If a personal visit is not possible, a recommendation should be obtained from a friend who has had success with birds from a particular farm. It is risky to buy pullets from unknown sources.

The Department of Agriculture administers the New Zealand Poultry Flock Improvement Plan and poultry breeders who support this plan have their flocks checked for health and their breeding birds examined for type, size, and quality. These breeding birds are blood tested for pullorum disease. Subject to the birds passing the plan

requirements, the owners' breeding flocks are accredited and their names and addresses appear on a list printed annually. A copy of this list may be obtained free from offices of the Department of Agriculture in all cities and main towns. Included in this list are the breeds and numbers of breeding female birds owned by each farmer.

Householders are not advised to buy laying stock from an auction mart, as normally the birds disposed of by this means are discarded hens and culls suitable for table purposes.

Management of Newly Purchased Pullets

Before the arrival of the new birds everything within the laying house should be ready. On the floor there should be a good layer of litter, which can comprise wheaten straw and/or wood shavings. A depth of 4in. of floor litter is sufficient when the birds are housed, but after they have broken it down, further litter material should be added until there is a depth of 6in. Nests can have straw, wood shavings, or sand placed in them, a 3in. coverage being sufficient. Fresh, clean water should be available for the birds as soon as they arrive and the container should be cleaned daily and replenished. A supply of oyster or pipi shell grit can be fed ad lib. in a hopper or some other suitable container.

Hard metal grit of ¼in. screenings assists the birds to assimilate their food, and a small container to hold this grit can be nailed to a stud several inches above the floor litter so that the grit is kept clean.

When the birds are delivered the purchaser should satisfy himself that they are up to a reasonable standard. They should be even in size, well fleshed, active, bright in the eye, and tightly feathered. If the householder collects the birds from the farm, he should satisfy himself about their quality and health before he takes them away. Should the birds arrive by transport they should be checked again on arrival and then given food and water.

Any birds that appear sick or not up to standard could be affected through travelling long distances; however, most venders make provision for birds to receive food and water when travelling, and it is the purchaser's responsibility to assess whether the birds are of poor quality or not. Any complaints should be made to the seller immediately. The purchaser should inspect the birds for any sign of stickiness or running of the nostrils, as this indicates they could have colds and therefore should not be accepted. The birds can be examined individually to see if they are lousy. Usually the lice are brownish grey and can be found on the skin and the feathers in the region of the vent. If these cannot be found, a check should be made for the lice eggs (nits) at the bases of the feathers in the same region as where the lice would be. Nits resemble whitish pieces of granulated lime.

[*Niederer*

The Rhode Island Red is gaining popularity in the heavy breeds.

A mating such as Australorp-White Leghorn usually results in "first-cross vigour".

Destroying Lice

Body lice can be destroyed very rapidly by painting the perches with nicotine sulphate about ½ hour before the birds go to roost. The treatment should be repeated 10 days to a fortnight after the first application. A trickle ¼in. wide should be painted on the top side of the perch; after the birds roost the heat from their bodies generates fumes which penetrate the feathers. Apart from nicotine sulphate there are other proprietary lines of perch paints available.

Treatment of Roundworms

The purchaser should inquire whether the birds have been treated against roundworms (internal parasites). Many poultry breeders make a practice of dosing all birds before they begin laying and usually give this service before supplying stock to customers. However, if the birds have not been treated, the new owner is advised to treat the birds as a routine measure. Each adult bird over 4 months should be given a 2 c.c. carbon tetrachloride capsule. The capsule is placed in the bird's mouth and can be guided down the bird's throat with the thumb and finger on the outside of its neck until the capsule is in the crop. This operation is quite simple to carry out.

When the householder is satisfied that the new pullets are healthy and up to standard they should be placed in their new quarters and given food and water. Birds should be handled with care and any movements made within the fowl house should be done quietly. Many farmers make a practice of whistling before entering the shed, as this tells the birds that someone is about to enter the house and they soon become used to this habit. Birds, like animals, respond to care and kindness, the exercise of which assists in gaining maximum results from the stock.

The Home Garden in March

TOWARD the end of March the days become noticeably shorter, the evenings cooler, and there is no mistaking the onset of autumn. With the first light frosts growth of tender and half-hardy vegetables is checked and though hardy vegetables continue to develop, growth slows as temperatures fall. In this article A. G. Kennelly, Horticultural Instructor, Department of Agriculture, Dunedin, discusses work in the vegetable garden for March.

LITTLE planting or sowing needs to be done in most home gardens in March. Toward the end of the month a sowing of onions can be made for planting out in August or for leaving in the seed-bed for pulling in November or December. In favourable situations a small sowing of carrots for spring use can be made.

Spinach can still be sown and spring cabbage, silver beet, shallots, and, in favourable situations, cauliflowers can be set out. In specially favoured districts where soil conditions are good, particularly in the north, sowings can be made of beetroot, turnips, and radishes.

Carrots

Carrots do not over-winter well in districts where winter temperatures are low, and in Canterbury and districts further south autumn sowing is rarely advisable. In districts where winter temperatures are relatively mild home gardeners desiring early spring carrots should make a sowing about the end of March.

The seed-bed for carrots should be well drained and worked down to a fine tilth. Where drainage is poor it is advisable to make a raised bed, and for convenience in cultivating and harvesting the bed should not be more than 3ft. wide. Soil heavily manured for a previous crop is best and sandy or light loams are specially suitable for autumn crops. Superphosphate at about 2oz. a square yard is likely to give good results on most soils that have been well cared for or a complete fertiliser can be applied. Seed should be sown thinly ¼in. to ½in. deep, according to whether the soil is heavy or light, in rows about 12in. apart. If the soil is light and free, there should be no need to thin, but on heavier soils the young plants can be thinned to about 2in. apart. If thinning is delayed, the thinnings may be used for soups and stews. A quarter of an ounce of seed will sow about 100ft. of row.

An early or quick maturing variety of carrot should be chosen for autumn sowing and a variety such as Early Horn will be found suitable.

Celery

In most home gardens the main crop of the self-blanching type of celery will be nearly mature or ready for blanching in March. Few home gardeners now grow the older, non-self-blanching type of celery, as it is usually slower and more difficult to blanch than strains of the self-blanching type. In general the green types are hardier and more robust and the texture and flavour of good varieties are superior to those of self-blanching types. Green celery has a higher vitamin content than blanched celery. Red strains of celery, though not much seen in home gardens now, are particularly hardy.

Most self-blanching varieties can be blanched in from about 10 to 21 days, but with the non-self-blanching or green varieties, blanching may take about 14 to 40 days according to variety, temperature, and the method adopted; that is, the extent of the blanching desired and whether it is done in stages. Blanching reduces the rather acrid flavour that some varieties of celery have when immature. This acrid flavour is caused either by the failure of the green colouring matter to develop or more commonly by its disappearance after it has been formed, particularly with green varieties.

Heading photograph by Green and Hahn.

Self-blanching celery is usually blanched by placing 10in. or 12in. x 1in. boards, held in place by pegs, around the sides of the bed. Suitably stiffened paper such as that used by builders (for example, laminated paper tarred on the inside and strengthened by fibre) can be used if desired in place of boards. The older, non-self-blanching type of celery can be blanched similarly, but as a much longer period is required for blanching, it is usually either wrapped individually with stout paper held with string or elastic bands or earthed up in fine weather with clean, free-working, reasonably dry soil which preferably should contain little organic matter and be free from the eggs of slugs or similar harmful creatures. Small or decaying outer stems should first be removed.

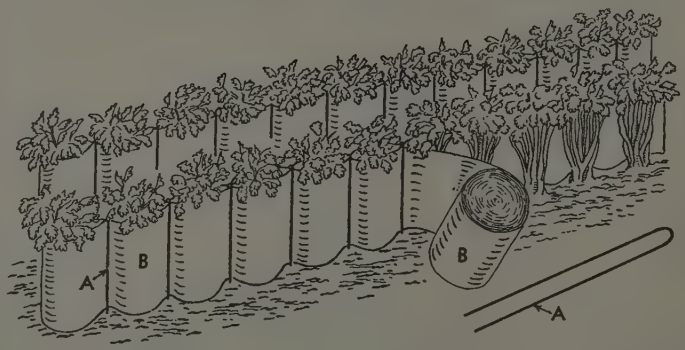
When finished the banked earth should be ridge shaped and the soil surface beaten smooth with a spade to shed rain. Under wet conditions rots are liable to develop if soil remains touching the inner stalks after earthing up is completed and the stems should therefore be drawn together when the soil is packed around them.

Though it is sometimes claimed that the quality of celery blanched with earth is superior to that of celery blanched by boards or paper, blanching with paper is quite satisfactory. A long strip of reinforced (laminated) paper should be placed along the sides of the bed and clipped in position with arched 10- or 12-gauge wires as shown in the illustration below. Rots often develop in soil-blanched celery in hot weather and blanching with soil is therefore most satisfactory in cool districts or in late autumn. As blanching causes a reduction in chlorophyll, it tends to check growth and should not therefore be begun until the plants are nearly ready for harvesting. If, however, a good head of leaves is left at the top, and if, where soil is used for blanching, it is not too tightly packed, the plant will continue growing.

Self-blanching varieties contain very little chlorophyll in their leaf stems or petioles and blanch very quickly. Blanching with soil is rarely practised with them, so the operation of blanching has little effect on their growth. The exclusion of light tends to make the leaf stalks more crisp and lengthens growth of the heart, which at the same time usually enlarges to some extent. Care should be taken when earthing up with soil to avoid getting lumps into the centres of plants, where damage may be caused to the developing heart.

Pithiness is a common fault of celery and is caused by the breakdown of the thin-walled cells that make up the substance of the leaf stem (as distinct from its outside and connective tissue). It may be the result of conditions of environment or it may be inherent in the variety. Pithiness resulting from conditions of growth is responsible for a great deal of loss in both commercial and home-grown celery. Though there is also a varietal susceptibility, pithiness caused by growing conditions is mainly found in the outer leaf stalks and increases as the plants mature, whereas pithiness which is inherent in the variety is equally distributed throughout the plant.

Home gardeners who have a large planting of one variety of celery and who intend to harvest it over a long period can begin blanching when the plants are about half to two-thirds grown. Plants are best harvested without delay after the blanching material has been removed. The fibrous roots should be cut with a sharp knife or spade just below the disc-like stem or crown, which should afterward be trimmed with a sharp knife. Poor coarse or pithy outer leaf stems should then be removed. With most self-blanching varieties it is necessary to remove all the outer leaves, but if a first-class variety is well grown and is harvested at the right time, few outer leaves need be discarded.



In addition to the usual methods of blanching by boards, by wrapping individual plants, or by earthing them up, celery can be blanched by using a roll of reinforced paper. Wire spanners (A) straddle the rows and are set in the ground deep enough to hold the paper (B). If good paper is used and stored carefully, it will last for many years. This method is suited to both the self-blanching and the older types of celery.

Marrows and Pumpkins

As long as the soil is not permitted to dry out, pumpkins and marrows usually require very little attention at this time of year. Once the plants are properly established and good laterals are developing it should not be necessary to pinch back or stop the leading growths unless they are invading a neighbour's garden or ground reserved for another crop. Shoots can be trained in the desired directions by driving short sticks on either side of the stems at intervals of 1ft. to 2ft.

If growing conditions are good and if the surface soil is kept moist and is well drained, the trailers sometimes root in the soil. This is a desirable feature, because it increases the weight of crop. Pegging encourages rooting and also prevents trailers from being blown about by strong winds.

The fruit of marrows should be cut when young, preferably before the skin hardens so that it cannot be broken easily by the thumb nail; 10in. to 12in. is a good size, as larger marrows usually have less flavour than smaller ones.

Early cutting of the fruit encourages the development of later ones. It is inadvisable to allow fruit to reach full maturity unless it is intended to grow mammoth specimens or to store fruit for winter. They store quite well and like pumpkins and squash, which should also be allowed to mature fully if they are to be stored, should be harvested carefully without being subjected to even slight frosts and stored under perfectly dry, frost-free conditions.

Pumpkins and marrows often become infested with aphides or green fly. In warm weather aphides multiply rapidly and unless checked they soon affect the plants. Some species of aphides exude a sticky substance on which a sooty mould grows, which makes the plant unsightly. Aphides also cause the leaves to curl and become distorted; the fruit and flowers too may become deformed. Aphides frequently transmit virus diseases which may cause serious reduction in yield or even the death of the plant.

Aphides are easily controlled by spraying with nicotine sulphate at 1 fl. oz. to 4 or 5 gallons of water. To this 2oz. of soap should be added to activate the nicotine. The spray should be applied on a still and preferably warm day and complete coverage should be the aim.

Onion Harvesting

Correct harvesting has an important bearing on the keeping quality of onions, most of which are harvested in February and March. The most suitable time should be determined by factors such as the weather, the con-

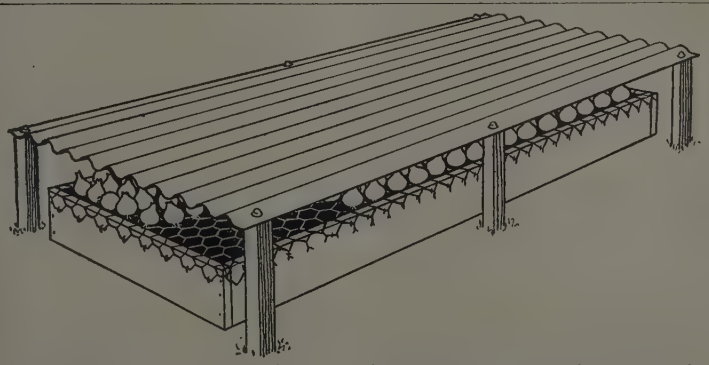
Cucumbers, squash, pumpkins, or trailing varieties of marrows can be used to cover an unsightly heap or corner. Provided there is adequate moisture, they grow well on compost or old manure heaps.

dition of the crop, and whether the onions are for fairly immediate use or for long keeping.

If bulbs are to be used almost immediately, they should be lifted as required when they have reached maximum or nearly maximum growth. If they are for long keeping, it is desirable that they should be cured, and in this condition the roots and tops should be dried off and the bulbs should be so hard that they are not readily dented by the thumb.

Readiness of onions for harvesting is indicated by drooping of the tops just above the bulbs while the leaves are still green. Gradual dying back from the tops of the leaves while the necks remain rigid, erect, and thick is an indication of abnormal ripening and usually of poor keeping quality. Insect pests or heredity may be responsible. There is likely to be a percentage of this type in practically all crops.

With the healthy well-grown onion that is ready or nearly ready for harvesting the roots lose their hold on the ground as they gradually die and the neck softens, owing to transference of the soluble solids of the leaves into the bulbs, until the outer succulent layers of the bulb nearly close the opening on the inner scales. After the necks shrivel the leaves gradually turn yellow and dry off even if the onion is not harvested.



Method of drying onions. Sun shining on the corrugated iron circulates warm, dry air about the onions set out on wire netting stretched on 4 pegs about 3in. below the iron.

If the onion bulbs dry off prematurely, the necks of the bulbs may remain open and allow various organisms which cause rots to enter. Premature drying off of the bulbs may be due to injury by heavy infestations of thrips or by damage to the roots by hoeing; growers sometimes hoe off the roots to cause premature death of the leaves and thus speed the drying off of the crop so that harvesting can proceed.

Except in a few areas conditions in New Zealand are rarely ideal for harvesting onions and it may not be possible to wait until the crop reaches the best stage for harvesting. Early frost is a risk in some districts. Light frosts do not harm onions, but heavy frost may cause severe injury. Onions with thick necks or that have not closed at the neck or bulbs left to dry that have been subjected to showers or to heavy dews are likely either to rot or take root again. Where conditions for drying are not likely to be suitable onions should be dried or cured under cover.

Drying or curing usually takes 3 or 4 weeks. In the lower-rainfall districts where a spell of fine weather is likely bulbs can be left on the ground. The tops should be left on to give them some protection from the sun, and if rain falls or there are heavy dews, they should be turned to enable them to dry evenly and to check rots, sprouting, or discoloration by the wet soil. After drying it is usual, though not essential, to top the onions by cutting or twisting the tops ½in. from the bulbs. Twisting is preferable, as it

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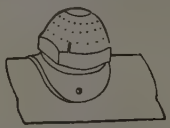

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closes the top of the bulb and the twisted leaves act as a barrier to the entry of rotting organisms. Alternatively the bulbs can simply be gathered when dry and packed in open-mesh bags or in shallow open boxes.

Though more space is needed for untrimmed onions, the tops are useful for cushioning the bulbs during handling and also in retarding the progress of rots that may develop. Where weather conditions are not favourable for curing in the field or where varieties, such as some of the white onions, that are difficult to cure are grown it is advisable to dry the bulbs in an airy shed or on a shelter such as that shown on page 133 before storage in open-mesh bags or boxes.

Where time can be spared stringing the onions as in the illustration on this page is an excellent method of handling the crop.

[*Photo News*

One of the best ways of keeping onions is to string them and store them in a dry, cool place.

Parsley

If an autumn sowing of parsley has not yet been made, seed can be sown now. Parsley is hardy and will stand the winter without harm anywhere in New Zealand. It is a biennial; that is, it goes to seed the second year. Parsley is usually rather slow to germinate and grow, but it responds well to good soil and to an abundance of nitrogen. Blood and bone at 2oz. to 3oz. to the square yard is a satisfactory fertiliser on most soils.

In most districts seed should be sown early enough to enable the young plants to become well established before the advent of cold weather. Provision is often made for slow germination by sowing a month or even 6 weeks earlier than would otherwise be necessary, but in well-drained, moist soil germination is usually not greatly delayed. Seed sown now is intended in most districts to provide supplies for next spring and summer, because in the well-planned garden parsley will be sown twice a year, in spring and autumn.

Seed can be sown in rows or broadcast on a small plot, but for the best results the plants should be set out about 1ft. apart when at the seedling stage. They make quite a good edging and do well in a cool, moist soil in the open or in semi-shade. Aphides are occasionally troublesome, but are readily controlled by spraying with nicotine sulphate 1 : 800 (½ fl. oz. plus 1oz. of soap to 2 gallons of water) or H.E.T.P. at 1 : 800.

Potatoes

Potato crops that are still growing should be kept weed free, but deep hoeing should be avoided, as the roots may be damaged.

Potatoes are mature when the skin of the tuber is firm and does not rub off easily, but while top growth is healthy and vigorous tuber development will continue. The tops therefore give the first indication of crop maturity and should be watched closely, as there is rarely any advantage in leaving the crop undug once maturity has been reached. During wet warm weather, second growth may occur and the tubers may develop knobby outgrowths, or small useless tubers may grow at the expense of the large ones. Insect damage is also common.

In the north particularly the potato tuber moth may lay eggs on tubers not properly moulded. Slug damage is not uncommon in New Zealand, particularly when the autumn is wet; millepedes and wire worms too are occasionally troublesome. Loss from insect damage may therefore be considerable. Growing tubers that are attacked by insects occasionally endeavour to grow round the point of attack or source of irritation and the knobbly outgrowths produced (not unlike those resulting from second growth) make such tubers very wasteful in preparation for the table.

In districts where crops are likely to be attacked by late blight they should be sprayed with Bordeaux or some other certified copper compound unless digging is to be begun without delay. If potatoes for keeping for several months are dug when underripe, there is likely to be heavy loss in storage.

Sweet Corn

Sweet corn is not a hardy vegetable; it thrives in warm, sunny conditions, and within limits the higher the temperature is and the more sunlight it receives the more likely it is to succeed. It can be grown in most districts in New Zealand, as it is less sensitive to cold than either the tomato or the snap bean, but it is not much grown in gardens in far southern districts. Sweet corn is not specially sensitive to drought and usually bears earlier on light, sandy, or peat soils.

Suckers often develop at the base of the plant during February and March and home gardeners sometimes remove them in an effort to increase the size and encourage early development of the cobs, but usually the practice is more likely to result in loss than gain, as the nutrients utilised by the suckers differ from the more complex compounds that go to the development of the cobs. Removal of large suckers results in loss of plant tissue which is capable of elaborating plant nutrients into substances which

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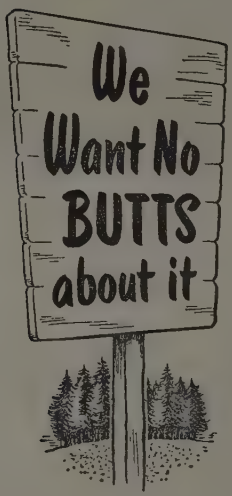

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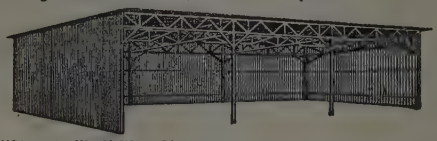

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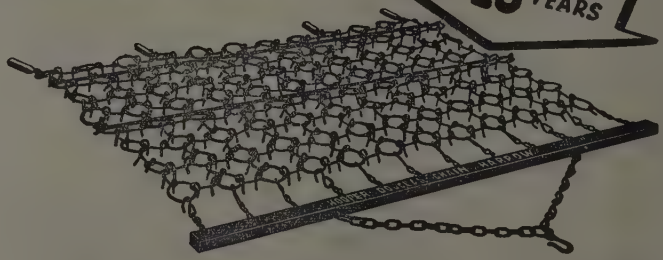

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go to the development of the cobs. It may also result in serious plant damage.

For the best results sweet corn should be harvested at the correct stage of development. It is at its best only for a short time, especially with early varieties. Corn cobs should be harvested in the milk stage while they are plump, juicy, and firm and the silk is fairly dry. The cob can be tested by pressing the thumb nail into one of the kernels. If a milky substance is forced out, the cob is suitable for harvesting; if a doughy substance comes out, the corn is usually considered over-ripe.

Corn should be used as soon as convenient after harvesting, because its sugar content changes to starch within about 36 hours. For those who appreciate corn at its best that is a good reason for growing corn in the home garden rather than buying it. If corn is not to be used soon after harvesting, it is best cooled and held at as near freezing point as possible, as then loss of sugar content is greatly retarded.

It used to be common practice for home gardeners to grow corn on "hills", but it is now generally agreed that there is little justification for the practice, as the raised soil surface about the corn tends to shed rain and makes watering difficult. Earthing up the stems of tall varieties is justified where winds are boisterous and the plants are not firmly established. It is a good plan, however, to grow corn in the sort of "hills" that are actually clumps, as corn is wind pollinated and pollen distribution is best where the plants stand in blocks.

[*Sparrow*

If potatoes are to be stored, they should not be harvested until fully mature.

[*Sparrow*

Sweet corn can be used for sheltering other crops. Harvesting should not be started until the cobs are at the correct stage of maturity.

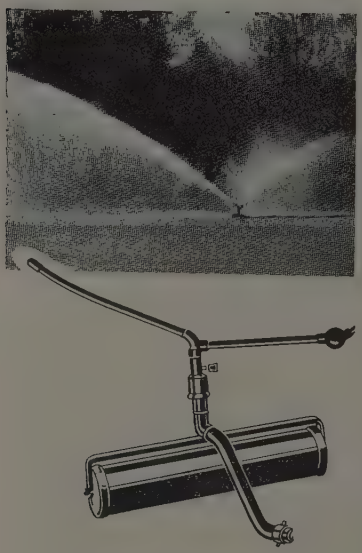
Winter Greens

Winter greens such as savoy cabbage, cauliflower, or broccoli, fine-leaved kale, and leeks should be kept growing strongly.

Pests such as caterpillars should be controlled by spraying with D.D.T. or D.D.D. Aphides and thrips can be controlled by using nicotine or H.E.T.P. sprays. If conditions are dry, the plants should be watered and in the poorer soils liquid manure made from animal manure or sulphate of ammonia at 1oz. to about 2 gallons of water should give improved growth. Alternatively, the soil can be top-dressed with sulphate of ammonia at about 1oz. to the square yard. In exposed situations it may be advisable to support brussels sprouts with stakes.

Compost

Though the making of compost has received a good deal of publicity in recent years, the practice is not new. Composts were formerly much used in European farms and gardens and the art of making them was well developed in Britain particularly by the middle of last century, when labour was cheap and plentiful and the prices of primary produce relatively high.



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Composting in the home garden has become increasingly popular and important in recent years, probably largely because of the difficulty of obtaining animal manure from farms and the relatively greater development of urban population resulting from industrialisation.

The importance in home gardens of returning all organic waste from the kitchen and garden to the soil can hardly be over-emphasised and the properly constructed compost heap offers an efficient method by which waste material can be converted to vitally needed humus. In most soils that have been intensively cultivated for a number of years without the return of adequate supplies of organic material which can be converted to humus it is difficult to maintain a good tilth. The soils tend to break down and lack body, and the maintenance of favourable conditions of moisture and aeration is thus difficult.

March is a good month in most gardens to start a compost heap, because a good deal of crop residue usually becomes available then and it is not always convenient to dig it into the ground immediately. Crop residues should not be burnt unless they are too woody to rot readily or are diseased.

The compost heap should be reasonably handy for the housewife and easily accessible with a wheelbarrow. Proximity to water, too, is a consideration in large heaps which dry out quickly.

Compost Heap

Layering of compost heaps may vary widely in detail, but the essential points are the provision of aeration and moisture and the mixing of material so that there is enough nitrogenous or sappy matter to rot the fibrous or woody material reasonably quickly. Lime is usually needed to reduce acidity, or rotting may be retarded.

A—Garden trash or household refuse to be rotted (layers usually about 6in. to 8in. thick). B—Material to speed rotting (that is, the activator). It may be fowl or animal manure, a heavy sprinkling of dried blood or blood and bone, or a sprinkling of nitrogenous fertiliser such as sulphate of ammonia. C—A sprinkling of carbonate of lime (ground limestone or common garden lime) can be used every 6in. to 8in. as the heap is being built. D—Twiggy material such as hedge clippings to provide aeration. E—Pipe for aeration. Adequate ventilation to induce a good draught through the mass is essential in the first stages of composting, but in the maturing heap it is not required, and may even be wasteful of organic matter such as nitrogen and ammonia. Pipes should be blocked or removed in the later, maturing stages of the heap. F—Soil to retain heat and for hygiene. Thin soil layers can be added as the heap is built.

Aeration

Compost heaps need not be of any special shape and the size will be determined mainly by the amount of material available. The important points to consider are aeration, retention of moisture, and drainage. Aeration from the base should be provided by a field or drain pipe or a quantity of open material such as woody hedge clippings, or both. Properly constructed bins usually have a grid at the bottom to which air is supplied by a pipe Adequate ventilation to induce a good draught through the mass is essential in the first stages of composting, but in the maturing heap it is not required, and may even be wasteful of organic matter such as nitrogen and ammonia. Pipes should be blocked or removed in the later, maturing stages of the heap.

Methods of composting vary widely in detail, but the principles are similar in all. Layers of the materials to be composted are alternated with thinner layers of farmyard manure or a heavy sprinkling of artificial manure rich in nitrogen. Lime is usually added to reduce acidity and so enable the bacterial activity to increase. Heaps are usually relatively long and about 3ft. 6in. to 4ft. wide and rarely higher than 4ft. In heaps smaller than about 4ft. wide by about 4ft. long the ratio of exposed surface is disproportionately large compared with the volume, and the breaking down of the material is slower. A bin is desirable for small heaps.

The rate of decay depends largely on the nitrogen content of the materials and the supply of moisture and air. For retaining walls wood is best, but wire netting will do. Stone, concrete, iron, or brick is usually considered less satisfactory unless side aeration is provided. No floor other than the earth is needed, though an air supply from the bottom is essential. A special wooden container, or preferably a series of them built so that the compost can be turned successively as breaking down proceeds, is excellent. A box about 12ft. long, 4ft. wide, and 4ft. high divided into 3 compartments by movable partitions and a movable end to facilitate turning and removal of the compost is suitable.

Activator

An activator is needed to speed the process of breaking down and either organic material such as fowl or farmyard manure or dried blood or mineral fertiliser such as sulphate of ammonia (either alone or in combination with other organic or mineral fertilisers) can be used.

Layers of the material to be rotted can be about 6in. to 8in. thick. Green, sappy materials should be laid loosely; drier and more strawy material should be moistened and firmed and preferably chopped up finely.

The carbon to nitrogen ratio for optimum breaking down is about 10 : 1. Sufficient nitrogenous or sappy material is therefore essential for speedy rotting. Layers of organic manure such as farmyard or poultry manure should be 1in. to 2in. thick according to the amount of litter the material contains. The less concen-

trated it is, that is, the more litter it contains, the thicker it should be. If dried blood is used, it should merely be sprinkled on fairly heavily. The manure can be topped off with a layer of soil and the next layer of trash then applied. Lime can be sprinkled either on the layer of soil or in the middle of the layer of garden trash.

When organic material for use as an activator is not available a more balanced plant food than that obtained by the use of sulphate of ammonia alone can be obtained by using a mixture of 4 parts of sulphate of ammonia, 3 parts of superphosphate, 1 part of muriate or sulphate of potash, and 2 or 3 parts of ground limestone, all by weight, at the rate of about 6lb. to 1cwt. of average, mixed, partly wilted garden trash. The more strawy or fibrous the material is in relation to sappy material the greater will be the amount of sulphate of ammonia required. (If the amount of sulphate of ammonia is increased, more lime also may have to be added.) When used alone as an activator sulphate of ammonia should be added at the rate of about 2lb. to 1cwt. of mixed, partly wilted garden trash; about 1 to 2lb. of carbonate of lime should also be used.

Air Vents

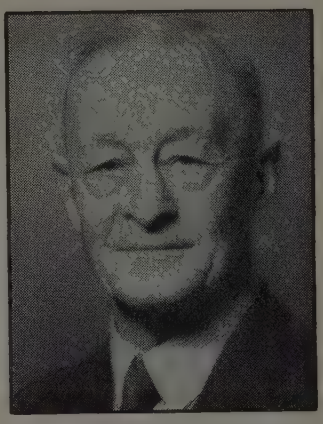
In very wet, soggy heaps rotting is usually speeded by making vertical air vents 3in. to 4in. in diameter at the top of the heap with a crow-bar or rake handle at intervals about 1ft. from the sides of the heap. Much depends on the material and the layering, but the temperature should rise within a week or two of the completion of the heap. When the heat begins to decline the heap should be turned (it by then should have sunk by about a third), the layers being mixed and the unrotted material turned to the middle.

A compost heap should be kept moist but not wet and it should be tested periodically for moisture content by inserting a stick, withdrawing it, and examining the adhering material for moisture. An unsheltered heap can be ridged to an inverted V to help shed rain. Exposed portions of the heap can be covered with a layer of soil 2 to 5in. thick to retain heat and moisture.

Spraying exposed heaps with D.D.T. will give protection against flies.

Death of Mr. G. M. Valentine

MR. G. M. VALENTINE, a former Director of the Dairy Division of the Department of Agriculture, died at Wellington on 3 December at the age of 79. He retired in 1946 after serving for nearly 34 years in the Dairy Division and for 56 years in the dairy industry.



MR. VALENTINE was born at Waikouaiti. In 1890 he began work with the Taieri and Peninsula Milk Supply Company, Dunedin. Three years later he went to the New Zealand Farmers' Dairy Union factory at Palmerston North, and the following year he became manager of the Featherston butter factory. He managed the Oaonui dairy factory in Taranaki from 1898 to 1902 and the Spring Creek dairy factory, Marlborough, from 1902 to 1912. In 1912 he became a Dairy Instructor of the Department of Agriculture at Auckland, where some of his work was of a pioneering nature. He was responsible for the introduction in the north of cream grading, that is, the classification of cream by quality and payment according to grade, from where it was extended throughout New Zealand. He also prepared an acidity reduction table which placed the use of neutraliser for the reduction and standardisation of acidity in cream on a proper footing. The table has long been the recognised standard for butter factory practice.

As Dairy Factory Superintendent representing the Dairy Division Mr. Valentine planned the dairy factory at Massey Agricultural College and the dairying courses which began there in 1928. He drew up the original dairy courses in dairy factory practice in manufacture, management, and routine. His wide knowledge and experience, his gifts as a leader and demonstrator, and his personality made him eminently suited to the task. His work at Massey College was of outstanding and enduring value to the industry. The spirit of good will and co-operation which Mr. Valentine helped to build up between the Dairy Division and the Dairy Research Institute was not the least of his achievements.

During 1933-34 he visited England and the Continent to study the consumption of New Zealand dairy products and to observe dairy manufacturing methods. On his return he was appointed Assistant Director of the Dairy Division, and on the retirement of the late Mr. W. M. Singleton in 1944 he was appointed Director.

Wairarapa Training Farm of Instruction

SINCE the scheme to give youths 15 to 18 years old a 2-year farm training course was arranged in 1951 by the Wairarapa Training Farm of Instruction 31 cadets have passed through the school. The success of the scheme is emphasised by the fact that the number of applications coming forward is far in excess of the accommodation available.

A survey of the training record of the farm to date shows that in 1951 eight cadets were accepted, in 1952 15 were in residence and seven completed training, in 1953 15 were in residence and eight completed training, in 1954 14 were in residence and eight completed training, and in 1955 16 are in residence.

In 1952 the first bursary, covering a diploma course in agriculture at Massey College and tenable for 2 years, was awarded to Cadet Keith Brown. In 1953 a similar bursary was awarded to Cadet Peter Russell.

Yearly examinations take place and before sitting his final examination at the end of 2 years' training a cadet is required to be able to plough, prepare a paddock for crop, erect a fence, shear a sheep, take charge of the dairy herd and shed, and be responsible for the pigs. If his work is successful, he is awarded a Certificate of Merit in Agriculture. During training cadets receive 4s. weekly as pocket money together with a delayed payment of £15 in their first year and 7s. 6d. pocket money with a delayed payment of £30 in their second year.

The area of 736 acres is farmed on essentially commercial lines and the training is practical with a syllabus of weekly lectures.

Cadets are accommodated in separate cubicles, ample shower and bath facilities are available, and they are under the care of a matron and a housemaster.

The scheme is aimed primarily for youths desiring to take up practical farming as a career and the committee of management comprises practical farmers.

Parents desiring to obtain further information of the scheme should apply to: The Secretary, Wairarapa Training Farm of Instruction, P.O. Box 11, Masterton.

Management of Harper Adams Pig Fattening House

TO obtain the best results from the improved types of pig housing which are being built throughout the Dominion there must be an appreciation of the higher standard of management required, particularly with feeding. If this is accepted and management is improved, the response of pigs being fattened will be immediate in cleanliness and ability to thrive on a reduced level of feeding. In this article E. D. Edwards, Technical Officer, Animal Industry Division, Department of Agriculture, Wellington, discusses the management of a Harper Adams house by a farmer in the Manawatu district.

THE Harper Adams type of fattening house is essentially a semi-enclosed house in which pigs have access to an outside yard for dunging and exercise. The enclosed portion, containing sleeping floor, feeding trough, and a race for feeding, is designed to provide warm, comfortable conditions for the pigs through reduced air space and insulation of roof, sleeping floor, and walls.

Mr. R. D. Craw, of Te Puna Road, Linton, built three units on the Harper Adams design in July 1953. The method of construction was briefly as follows:—

Foundations were dug out for the walls, and feeding floor, dunging area, and races laid in the usual manner. The sleeping floor consists of a thin skin of concrete over an earth fill to form a base for a 3in. layer of coke breeze concrete (6 : 1 mix). To seal the surface a ¼in. layer of cement plaster was applied.

The walls are of hollow block concrete plastered internally about the sleeping floor. The roof is of corrugated iron over builder's paper and wire netting, with a lining of wood pulp wallboard beneath the roof members.

As the house was one of the first of its type erected in New Zealand, it has no side wall between the sleeping floor and the side passage, a feature incorporated in more recent houses to prevent draughts from the opening to the outside yard. In two of the units at Mr. Craw's piggery the fall on the sleeping floor is directly to the side passage at ¾in. to the foot. The remaining unit has the fall to the front and along the feed trough to the side passage, also at ½in. to the foot. Experience has since proved both methods to be effective in keeping the sleeping floor clean and dry.

Method of Management

The Harper Adams fattening house has become well established in England, where meal feeding is common. However, when Mr. Craw began using his house there was no experience with the house under New Zealand liquid-feeding conditions to guide him.

By the process of trial and error, which extended over at least 6 months, a pattern of management was evolved which Mr. Craw considers gives the best results at his piggery. That there is an art in feeding pigs, particularly in this type of building, soon became apparent, and a careful watch is kept on the nature of the dung passed. At the first sign of loose dung the feed is reduced to a level that will cause only firm dung to be passed.

Regularity in Feeding

The pigs are fed three times daily—after the morning and evening milking and at midday. If Mr. Craw or a member of his family is not available to feed the pigs at midday, that feed is omitted. He makes no attempt to fill troughs before going to town or on return, as is commonly done, as this is more harmful than starving the pigs for a short period.

HEADING PHOTOGRAPH: Mr. Craw's piggery. At left and middle are open-fronted farrowing houses and at right the Harper Adams type fattening house.

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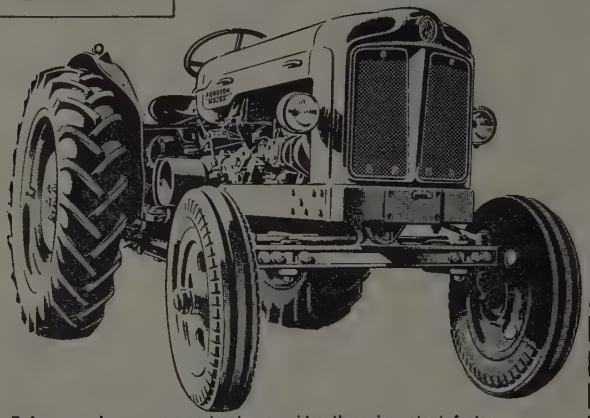

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Looking along the feeding race in the Harper Adams house. If care is taken to avoid spilling of milk, the race can be kept clean and dry. When the photograph was taken the race had not been washed out for about 2 months.

The following illustrates the importance Mr. Craw attaches to feeding the correct amount of skimmed milk. Normally he alone attends to the pigs, but occasionally when this is not possible his son does the job. To ensure that the pigs are given the correct amounts Mr. Craw leaves written instructions with his son, believing that this is much easier than cleaning up the mess in the house that would result if the pigs were overfed.

Skimmed milk is always fed sour. It is stored in drums for 2 days until the junket stage is reached. By consistent feeding of it in this state the pigs are less likely to suffer digestive upsets. Surplus milk (and under a system of rationing there is frequently a quantity) is stored in drums to be preserved as curd for feeding in times of milk shortage.

Meal Feeding

Meal is fed to the pigs from the time they will take it in the creep until 2 to 3 weeks after weaning. The litters are farrowed in units which for that particular purpose are rather inadequate in the protection they afford baby pigs. Depending on their progress with their mother, the pigs are weaned at between 6 and 8 weeks and are transferred to the fattening house when a pen becomes vacant.

The meal used consists of meat meal and barley meal in the ratio 2 : 3. This is stirred into the milk and fed three times daily. Approximately 2lb. of meal is given per pen at each feed when the pigs first enter the house, and this amount is gradually reduced after 2 weeks, ceasing at 3 weeks.

Quantities of Milk Fed

Mr. Craw feeds as much skimmed milk as the pigs will take without scouring until the heavy porker stage is reached, when a standard ration is fed. Under this method of feeding weaners receive approximately 2 gallons of milk daily when meal feeding has ceased, 80lb. porkers 3½ gallons, and pigs within the dressed weight range 110lb. to 150lb. only 4½ gallons.

The generally recommended level of feeding for a pig of 80lb. dressed weight is 4 gallons. This should indicate the saving in food possible in this type of house with careful management.

Unfortunately no detailed record of rate of growth can be given, but Mr. Craw states that the autumn-farrowed pigs reach 120lb. dressed weight by the time their dam has farrowed again. Not many pigs on this farm reach 40lb. at weaning, because inadequate use is made of the creep. The average weight at weaning would be probably 30lb., and management over this early period has a marked effect on the growth and development during later stages.

Disease

Slaughter records reveal one case of abscess only in the period since July 1953. Mr. Craw admits that some pigs have been tender on their feet and feels that a bluestone foot bath would be a wise investment.

Absence of respiratory ailments such as pleurisy and pneumonia is encouraging. These troubles are associated with damp, draughty conditions frequently encountered in piggeries.

Modern pig housing should eliminate these undesirable features, but success in this direction still depends on careful management.

Training Pigs to Keep Quarters Clean and Dry

Immediately after the weaners have had their first feed in the house they are chased outside to the rear yard and the small opening is blocked with a box. When they have emptied themselves they are allowed to return. This procedure is repeated after each feed until the pigs become aware of what is expected of them.

A further measure adopted with all pigs in the house is that before feeding in the morning all pigs are chased out into the dunging area to relieve themselves.

That these methods, combined with careful feeding, are effective in keeping the sleeping floor clean and dry can be judged by the cleaning required.

Frequency and Method of Cleaning

The sleeping floors and feeding area are kept remarkably clean and require no attention from the time the pigs enter the house as weaners until they are marketed as baconers. The floors are then thoroughly scrubbed out and disinfected before the next lot of weaners are put in.

During the first 2 to 3 weeks after weaners enter the house the side passage of their pen may require daily cleaning, but it has been found that a bucket of water tossed down the passage is all that is necessary.

The outside dunging area is cleaned daily. The dung is swept into a heap and shovelled into a barrow. When it is deemed necessary water is bucketed to the area and the floor washed down. The regular cleaning of this yard assists in keeping the interior clean by avoiding the transfer of much dung there on the pigs' feet. As a further precaution, after each feed or as thought desirable, a few quick sweeps of the broom are made from the rear race and the dung swept into a lower corner of the yard. This involves very little time and is facilitated by the dung being firm.

The feeding passage inside the house is cleaned out every 2 months with water and a broom. Care is taken at feeding times to prevent milk from dripping or splashing over this floor. Besides reducing the amount of cleaning necessary this assists in maintaining a suitable environment in the piggery.

TABLE 1—TEMPERATURE RANGE INSIDE HOUSE AND OUTSIDE

Month	Inside Max. deg. F.	Inside Min. deg. F.	Inside Range deg. F.	Outside Max. deg. F.	Outside Min. deg. F.	Outside Range deg. F.	No. of pigs	Average live-weight lb.
February	84	73	11	82	63	19	27	50
June	54	50	4	55	45	10	25	55
December	71	64	7	67	57	10	26	130

Pedigree Sow Records

Contributed by the Animal Industry Division

In the period July to December 1954 the following breeders had litters recorded as shown:—

Owner's name and address	Herd book number: Sow	Herd book number: Sire	Number of pigs: Born	Number of pigs: Weaned	Litter weight: 3 weeks lb.	Litter weight: 8 weeks lb.	Litter grade*
Berkshire							
Snelling, F. R., R.D. 3, Whakatane	27981	28103	9	9	73	249	5
Ellerm, O. C., Palmerston North-Sanson R.D.	28242	29213	13	11	133	490	1
Ayson, W. R., Aparima R.D., Otautau	29396	28157	12	10	99	313	3
Tamworth							
Smith, F. E., Orongo, Turua	16379	17779	12	11	137	421	1
Jacobs, W. H., Matai, Ahaura	17448	16860	10	9	126	384	1
Jacobs, W. H., Matai, Ahaura	17761	17888	7	7	116	378	2
Large White							
Knight, H., The Avenue, Levin	11925	11926	13	9	126	449	1
Harper, R. J., Broadlands R.D., Reporoa	11332	11345	15	14	129	450	1
Harper, R. J., Broadlands R.D., Reporoa	11332	11345	12	6	71	224	5
Harper, R. J., Broadlands R.D., Reporoa	11951	11453	12	10	79	361	5
Heppenstall, G. E., Whitney Mangarorongo Road, Otorohanga	9765	10765	16	10	126	389	1
Heppenstall, G. E., Whitney Mangarorongo Road, Otorohanga	11400	9038	10	10	127	365	1
Kovalski, R.D., P.O. Makaraka, via Rotorua	11794	11577	13	11	120	385	1
Misa Brothers, P.O. Waiuku	12212	11979	13	12	97	305	3
New Plymouth Boys' High School, P.O. Box 187, New Plymouth	9931	10368	10	8	146	364	1
Mutton, R. S. A., R.M.D. Te Puke	11159	11763	13	12	117	563	2
Mutton, R. S. A., R.M.D. Te Puke	10209	11763	14	9	99	386	3
Large Black							
Thompson, R. H., Green Road, Kopane R.D., Palmerston North	6365	4694	8	7	89	274	4
Thompson, R. H., Green Road, Kopane R.D., Palmerston North	6364	4368	15	8	88	242	4

Minimum Litter Weight for Grades

Grade*	3 weeks (lb.)	8 weeks (lb.)
1	120	360
2	100	300
3	90	270
4	80	240
5	70	210

Breed Averages for the Period under Review

Breed	Number of litters recorded	Number of pigs: Born	Number of pigs: Weaned	Litter weights: 3 weeks lb.	Litter weights: 8 weeks lb.	Average weight per pig: 3 weeks lb.	Average weight per pig: 8 weeks lb.
Berkshire ..	5	11.2	9.0	90.2	277.8	9.9	29.7
Tamworth ..	4	9.3	8.5	110.0	358.0	12.7	42.5
Large White ..	11	12.8	10.0	111.0	380.1	11.3	38.7
Large Black ..	2	11.5	7.5	88.5	258.0	11.9	34.7

* A No. 3 grade is classed as good, No. 2 as excellent, and No. 1 as special.

Control of Temperature and Ventilation

The fattening house has two stable doors at each end of the feeding passage and a window opposite each unit. Normally the upper door at one end is open during the day and closed at night. As the piggery has to be visited three times daily, doors and windows can be adjusted to provide reasonable conditions for the pigs at all times.

Table 1 shows the daily ranges in temperature in the house under Mr. Craw's management compared with those outside on three occasions during the past year.

Provision of a water spray in the yard adjacent to each sleeping floor would assist in keeping the inside maximum temperature down to 70 to 75 degrees during hot weather.

Breed of Pig

Mr. Craw uses a Large White boar over both Large White and Berkshire sows, but favours the Large White-Berkshire first cross pig.

Effect of House on Production

Before the erection of the Harper Adams house the pigs were fattened in units used at present for farrowing and dry stock. These are wooden with an iron roof and have open fronts protected by hoods. Each house has a 12ft. x 8ft. concrete yard in front with provision for a creep at the far end of the yard.

A litter of 8 pigs was carried through from weaning to baconer weight in this pen without the sleeping floor requiring to be touched.

Mr. Craw uses curd preservation to help to secure full utilisation of the milk available.

Drafting race built into the yards of the revised Harper Adams plan. This house is on Mr. J. Dickinson's farm, near that of Mr. Craw.

Before the Harper Adams house was built only 4 sows were kept. During the present season 7 sows have been bred from.

At first Mr. Craw planned for production of porkers because of the favourable prices ruling, but the reversal in prices this season has caused emphasis to be switched to baconers. Even so Mr. Craw is confident of managing 7 sows as a result of his experience with the new fattening house.

Some details are available which lend support to this belief and which indicate the nature of the increase in production possible when pigs are housed well and managed carefully. Production of butterfat from the herd of 55 cows was fairly steady during the 1953-54 season and has continued to be up to early December this season. Pigmeat prices were stable until October 1954, when pork prices particularly received a check. The values of pigs sold on the hooks during the last two seasons are as follows:—

July 1952 — June 1953 .. £450
July 1953 — June 1954 .. £550

The increase in returns can safely be attributed to improved use of almost exactly the same amount of food through the new fattening house. Mr. Craw is aware of room for improvement in the care of litters on the sows and also in finishing off porkers in autumn. These phases would influence returns considerably. However, the technique he has developed in managing the Harper Adams fattening house to derive maximum benefit from it shows the standard of management that is required and can be achieved with these houses.

This 3-unit house cost £70 per unit for materials and was built by Mr. Craw and his father-in-law. The house took 2 months to complete, but construction was delayed somewhat by bad weather and other farm jobs. Nevertheless Mr. Craw is very pleased with the result and intends adding another unit in the near future.

Guide to Other Farmers

This article gives the experiences of one of the first farmers to build a Harper Adams house in this country. The method of management found to be necessary in the house for best results should be noted by all pig farmers. It would appear that on many farms pigs are being grossly over-fed when milk is plentiful, resulting in much waste of food and an overfat carcass, an article the trade does not want. Further, the rations for fattening pigs recommended in the article "Fattening Rations for Pigs", in the December issue of the "Journal", though intended as a guide only, may need to be reviewed and some reduction made to secure the most satisfactory results in modern, well-insulated houses.

Ryecorn as a Greenfeed Crop

CEREALS are often grown for supplementary feeding during winter and early spring. A practice has developed on the lighter pumice soils of the Rotorua district of selecting ground for the following season's swedes in the preceding February and preparing it for a greenfeed crop to be grown not later than mid-March. Normally such an area would be in relatively poor pasture from which little production could be expected during autumn, winter, and spring. Preparation of such land for a crop in February and sowing greenfeed cereals in March has demonstrated that an otherwise low-producing piece of land can be made to yield useful quantities of nutritious herbage for dairy cows and sheep at times of greatest need. Moreover the old turf has rotted and the land is in a better condition for the following crop, which is generally swedes. Recent experience has shown that ryecorn sown at 3 bushels per acre with 3cwt. of superphosphate or serpentine superphosphate not only outyields considerably cereals like oats (Algerian and Gartons) and barley (Cape and Black Skinless) treated similarly, but is also highly palatable when kept at the 4in. to 6in. stage of growth. Root crops sown after this treatment have done better than in ground freshly taken from pasture.

—*C. R. TAYLOR,*
Fields Instructor,
Department of Agriculture,
Rotorua

Treatment of Extracted Honey in Small Apiaries

Seasonal Notes for the Domestic Beekeeper

ALL honey produced is in the first place contained in combs made by honey bees, but the bulk of that used for human consumption is extracted from the combs and is sold either in a liquid or granulated condition. The production of fine-quality extracted honey which will remain in excellent condition over a long period often presents a considerable problem to the small beekeeper who lacks the necessary equipment. To assist beekeepers, and particularly beginners in beekeeping, to reach the desired standard, this article by D. Roberts, Apiary Instructor, Department of Agriculture, Auckland, deals with the fundamental principles which should be observed if a high-quality product is to be obtained consistently.

BEEKEEPERS producing extracted honey will find the use of a honey extractor essential to the production of a high-grade article. The extractor is a simple machine consisting of a revolving reel fitted with wire baskets to hold the combs and built into a metal container. When the cappings are removed and the combs placed in the baskets, revolving the reel causes the liquid honey to be flung from the combs to the sides of the container, whence it drains down to the bottom and is drawn off through a tap.

Honey removed from the combs by an extractor will be much more free from air bubbles and wax particles, pollen, and other foreign matter than will honey removed by other means. The act of pressing or squeezing honey from the comb must in itself incorporate many fragments of wax and pollen in the honey. Extracted honey will also strain much more readily than will pressed honey and there is not the same risk of the flavour being impaired by the incorporation of foreign matter. Two-frame, hand-powered extractors suitable for the small producer can be obtained from most suppliers of apiary equipment.

Extracting

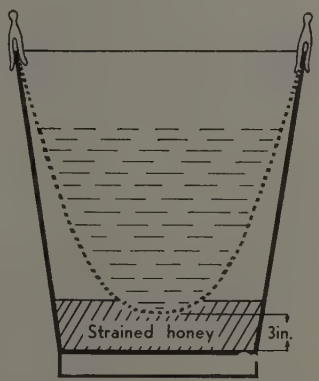
With honey to be extracted, as with comb honey, care should be taken to see that it is fully ripened and capped over before being removed from the hive. Combs selected for extracting should not contain brood, as this may be flung out in the extractor and mixed with the honey. The utmost cleanliness and care should be exercised at all times in the selection of combs for extraction.

All honeys will extract much more readily when warm from the hive or at hive temperature than they will when allowed to become thoroughly cooled in the comb. Some of the heavy bodied honeys, such as that gathered from manuka, are difficult to extract even when warm and frequently require the use of an implement known as a pricker pad, particulars of which may be obtained from the local Apiary Instructor. If allowed to cool thoroughly in the comb, some of these honeys will be impossible to remove cleanly without pressing or destroying the comb. If no means of maintaining the honey at or near hive temperature are available, beekeepers whose crop is likely to be heavy bodied should not remove more from the hive at one time than can be extracted conveniently while still warm.

Before the honey is extracted the cappings must first be removed. This requires the use of a really sharp knife. If a considerable number of combs are to be uncapped at one time, better results will be obtained by using two knives which are heated by being stood in a can of water kept hot on a small spirit stove or electric element. The knives are used alternately and should be wiped dry before use. Uncapping knives with bevelled edges are available from retailers of beekeeping equipment for this work.

Straining

Though the use of an extractor ensures the initial production of as clean a honey as possible, the honey will still contain wax fragments and grains of pollen and it must be strained thoroughly to remove these. Honey strains best while warm and straining should take place as the honey leaves the extractor. Suitable strainers can be purchased from suppliers of apiary requisites or may be made by the beekeeper. For home manufactured strainers wire gauze of the size about 45 to the inch mesh will be found to meet most requirements.



Cheesecloth strainer made from two thicknesses of cheesecloth attached by clothes pegs to the top of a bucket and suspended so that it forms a loose bag.

Above—Removing cappings from extracting comb, showing correct way of holding comb. Below—Incorrect method of removing cappings. If the knife slips, the operator's hand will be badly cut.

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Left—Liquid honey. Middle—Honey with starter properly mixed in. Right—Final granulation.

Where only small quantities of honey are being handled a satisfactory strainer can be made by using two thicknesses of cheesecloth. This is attached to the top of a bucket by clothes pegs and suspended so that it forms a loose bag inside with the bottom of the bag not more than 3in. from the bottom of the bucket. Not more than 3in. should be allowed, as honey passing through a strainer and falling more than a few inches through air will become filled with tiny bubbles. At no stage in processing should liquid honey be allowed to fall freely through air. If it is to be run or poured from one container to another, it should always be led so that it runs down the side of the receiving container rather than be allowed to fall and splash. Incorporation of an excessive quantity of air bubbles in honey creates a cloudy appearance and may seriously impair its keeping qualities.

Though proper straining will remove most foreign matter from honey, it should be clarified further by being stood in wide-mouthed containers for at least 24 hours. If the containers are kept in a warm, dry place, air bubbles, wax particles, and any pollen grains remaining in the honey will rise to the surface. Foreign matter can then be skimmed off. As there is a possibility that the honey will absorb moisture from the atmosphere during clarification, the containers should be well covered with some non-porous material, such as plastic cloth, so that contact with outside air is avoided.

Immediately the honey has been strained and skimmed it should be put into containers. For home use pint or quart glass preserving jars will be found suitable. When the jars are being filled at least ¼in. space should be left between the honey and the lid; otherwise staining may occur if the honey comes in contact with a metal cover.

Liquid Honey

Where it is desired to retain the honey in liquid form it should be stored only in warm, dry conditions. Most honeys will granulate in time, but granulation, or crystallisation as it is sometimes called, occurs much more rapidly at lower temperatures. Temperatures below 65 degrees F. and not lower than 55 degrees tend to favour rapid granulation, and honey to be kept liquid should not be stored where these temperatures are liable to occur. If granulation does occur in storage, the honey can be reliquefied before use by standing the container in hot (not boiling) water.

Granulation

Where granulated honey is the object it must be borne in mind that honeys will granulate in different ways according to the source from which they are gathered. Some will naturally form a close-grained, smooth granulation, but with many the crystals formed will be coarse and uneven.

To ensure that fine granulation occurs a starter honey should be used. The beekeeper should obtain sufficient of a good fine-grained honey to provide 1lb. of starter to every 20lb. of honey to be granulated.

When the honey has been skimmed and is ready to pack, the starter should be stirred in thoroughly. The starter must be completely incorporated, and stirring should continue until both honeys are mixed so that few or no streaks of starter honey show in the mass. If the starter honey is found to be too firm to mix readily, it should first be softened by being stood in hot water until the portions against the sides of the containers are nearly liquid and the whole then softened gradually by slow stirring before use. The starter honey must not be completely liquefied or its advantages as a starter will be lost. When finally packed and sealed the honey should be stood in a cool place, at a temperature between 55 degrees F. and 60 degrees if possible, to assist rapid granulation. Honey processed and cooled in that way should reach the stage of crystallisation inside a week, when it should be removed and placed in ordinary storage where it is not too warm.

Care in Handling

The exercise of proper care during removal of honey from the hive, extracting, straining, bottling, and storage will reduce risk of deterioration to a minimum. Particular care must be taken to ensure that honey is not exposed to a moist atmosphere, either in the comb or during extraction and packing. Extraction should be carried out only in warm, dry conditions, and any honey held in containers before packing should be well covered with air- and moisture-proof covers. Lids of tins or jars must be fastened so that they remain airtight. Extractors and all other equipment used in extracting and packing must be thoroughly clean and dry before use and should not be used from day to day without thorough cleaning at the end of each daily run.

As honey will absorb foreign flavours, it should not be treated or stored close to substances having strong adours.

Provided that storage conditions are suitable, extracted honey properly processed and packed will remain in good condition indefinitely. Storage conditions are of great importance, because continued exposure to high temperatures will cause darkening and loss of flavour, and storage for long periods at low temperatures may induce fermentation when the honey is removed from such storage.

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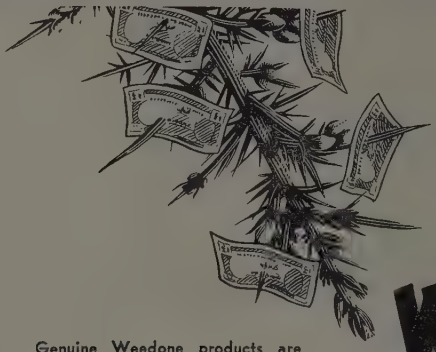

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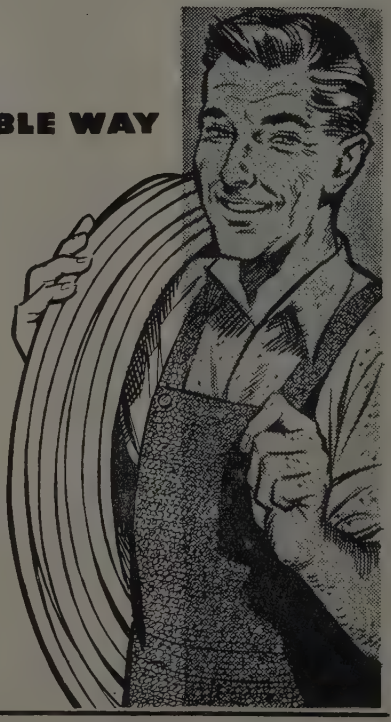

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Poultry Husbandry in Britain

THIS article is the first of a series by F. C. Bobby, Superintendent, Poultry Industry, Department of Agriculture, Wellington, describing methods of poultry husbandry practised in Britain and the poultry industry there. In July and August of last year the writer attended the 10th World's Poultry Congress in Edinburgh and during that visit had the opportunity of studying British poultry farming. In this article he discusses the organisation of the industry, the facilities available for training in poultry husbandry, and breeding practices. Later articles will deal with commercial egg production and marketing.

IN Britain figures are collected annually of the number of poultry naintained on properties of 1 acre or more, and the returns for June 1954 showed a poultry population of about 66,000,000 birds. It is estimated that a further 20 per cent. may be added to this figure to include birds kept on smaller properties and therefore not shown in the Agricultural Returns; up to 60 per cent. of the 66,000,000 birds are probably in flocks of 50 or fewer birds. This figure is similar to that in New Zealand, but the number of household poultry units in New Zealand—units of 24 birds or fewer—is higher proportionately than in the United Kingdom. At the 1951 Census in New Zealand 89 per cent. of the total number of flocks were units of under 25 birds; indications are that the number of household poultry flocks is still increasing.

Specialisation of Industry

The poultry industry in the United Kingdom contains a number of well-defined specialist sections. In addition to pedigree breeders and commercial egg producers there is a table poultry association, a turkey association, and a chick producers association. This indicates a greater tendency to specialise in branches of poultry husbandry than in New Zealand, though specialisation is now developing in this country more rapidly than before.

Industry organisation is tied in with the National Farmers' Union, in which there is a poultry committee. All sections of the industry and all parts of the country are represented on that committee, which is large and consists of about 60 members. Sub-committees study specific problems and an executive committee negotiates with Government representatives.

The Ministry of Agriculture and Fisheries has a well-organised, comprehensive advisory service for all classes of poultry producers. This service is given by officers of the National Agricultural Advisory Service (N.A.A.S.), who are stationed in all counties. Dealing directly with poultry producers are Poultry Officers and Veterinarians. The number of Poultry Officers (equivalent of Poultry Instructors in New Zealand) in each county varies with the poultry population of the area. The work of these officers is co-ordinated and supervised by Provincial District Poultry Officers. Poultry Officers in all counties are responsible for administering the conditions of the Poultry Stock Improvement Plan, which are laid down by the Ministry of Agriculture. Blood testing for pullorum disease is carried out by blood testing officers employed by the Ministry of Agriculture. These officers work separately from the Poultry Officers, who are not called on to carry out this class of work. Women are employed to a large extent for blood testing.

Poultry Husbandry Training

Training in poultry husbandry may be obtained at a number of colleges and institutes throughout the country. Practical courses are available for those who intend to poultry farm, and longer detailed theoretical courses in all aspects of poultry husbandry are available to those wishing to sit for the National Diploma in Poultry Husbandry (N.D.P.). Holders of this diploma usually supply the personnel for the National Agricultural Advisory Service (Poultry Officers) and are often sought to fill positions with poultry food manufacturers as technical advisory officers.

HEADING PHOTOGRAPH: Ideal conditions for growing stock. Many pedigree breeders in Britain consider free range for growing pullets and cockerels to be essential for good husbandry.

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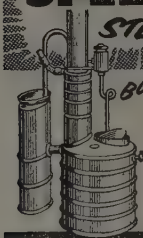

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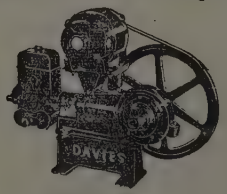

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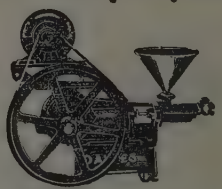

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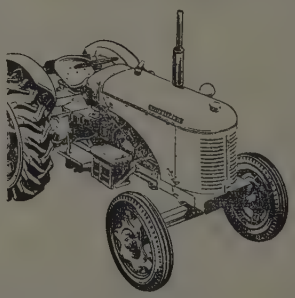

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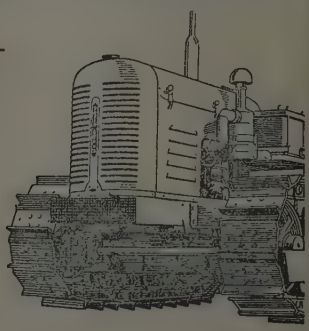

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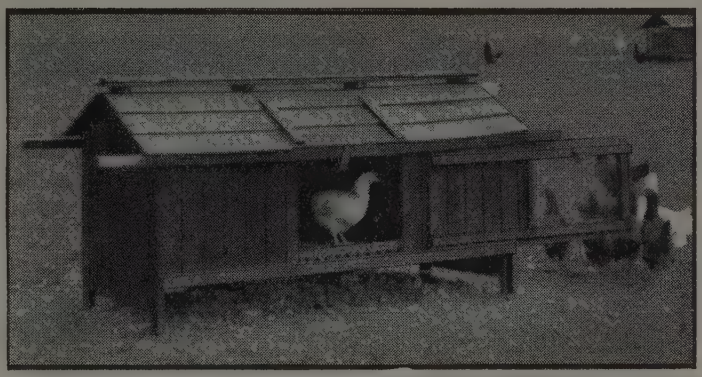
The poultry educational centre of outstanding merit at present is the National Institute of Poultry Husbandry at Newport, Shropshire. This institution has a complete teaching staff and a poultry plant which demonstrates all branches of poultry husbandry, including breeding, the various systems of commercial egg production, table poultry production, and the raising of turkeys, ducks, and geese.

The poultry industry in the United Kingdom is fortunate in having a number of research units where work covering a wide field is undertaken on behalf of poultry producers. There is the Poultry Research Centre, Edinburgh, the poultry research unit of the Animal Health Trust, St. Ives, the Poultry Genetics Station, Cambridge, the National Institute of Poultry Husbandry, Newport, and the Northern Breeding Station, Reaseheath. In addition investigations into egg quality are being made at the Low Temperature Research Laboratories, Cambridge, and by the Ministry of Food in London. British Oil and Cake Mills Ltd., large manufacturers of poultry and animal foods, have an experimental station at Stoke Manderville a large proportion of which is devoted to poultry research work. This firm has also made some excellent films on poultry production. Copies of some of these have been brought to this country by the New Zealand Poultry Board and have been shown to many poultry producers throughout New Zealand.

The poultry industry in the United Kingdom is therefore well organised and supplied with well-developed advisory, educational, and research services. Until the beginning of 1954 it had been under wartime and post-war restrictions and is only now gradually redeveloping under normal conditions. Up to September last the industry was still awaiting a post-war marketing plan and it was difficult at that time to see along what lines egg marketing, freed of all Government imposed restrictions, would develop. Further reference will be made to this in another article in this series.



The Sussex ark colony house for growing birds on free range is much favoured in England. The floor is of wooden slats. The wire sliding door for closing up the ark at night is essential where foxes prowl round after dark.

Breeds and Breeding

The most popular breeds in the United Kingdom at present are Light Sussex, Rhode Island Reds, White Leghorns, and Black Leghorns; there are also appreciable numbers of Buff Rocks, New Hampshires, and Anconas. Most commercial egg producers depend on flocks of crossbred pullets for their livelihood. Many crossbred birds were kept before the Second World War, but there has been a substantial increase in the use of this class of stock for egg production since the war.

It was surprising to find that old-established breeders are now running at least two pure breeds and crossing these to meet a growing demand for crossbred day-old pullets. Some breeders go as far as to state that the sale of crossbred chicks represents the main source of their incomes. Before the war these breeders depended for a livelihood on the sale of hatching eggs, chicks, and stud cockerels from pure-bred stock.

A further development of interest is an attempt to raise the quality of crossbred chicks sold by commercial hatcheries. It is being done by establishing a link between the outstanding breeders in the country, referred to as

A good flock of Light Sussex pullets on free range in Scotland. These birds are running under healthy conditions and are afforded shelter from the trees in the background.

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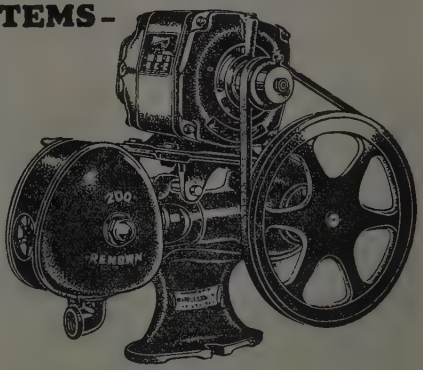

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Left—When the rearing season is over the owner of this farm takes the precaution to preserve and disinfect all housing and equipment by the use of creosote. These girls are responsible for rearing more than 4000 chickens through the brooder stage each year. Right—A double-unit brooder house used by a breeder who believes in rearing in small units of 100 chicks. A ventilating cowl is provided on the ridge of the roof and the runs are of fresh grass.

the master breeders, with the commercial hatcheries.

The master breeders sell day-old cockerels of two separate breeds (say, Rhode Island Red and Light Sussex) from their best stock to what are termed hatchery breeders, who have already established good-quality breeding flocks and are capable of making full use of the high-quality cockerels from the master breeders. The hatchery breeders multiply the two pure breeds maintained and supply stock to the third type of farm in this chain of production—the hatchery supply farms. Here the two breeds are cross mated and all the hatchery eggs are sent to the commercial hatcheries concerned.

Crossbred Pullets for Egg Production

A number of first crosses are being used to produce crossbred pullets for egg production. Among the most popular are Rhode Island Red x Light Sussex (sex-linked cross), Light Sussex x Rhode Island Red (no sex-linked progeny), White Leghorn x Rhode Island Red, Black Leghorn x Rhode Island Red, and Brown Leghorn x Light Sussex (sex-linked cross). The male bird of the cross mating is mentioned first in each case. Where a light breed and a heavy breed are crossed the light breed male is used. This is a common breeding practice in the United Kingdom.

When crossbreeding first became popular in New Zealand there was a tendency to give insufficient consideration to the quality of birds used. After birds for pure matings had been selected what was left was considered good enough for cross matings. Fortunately this undesirable practice has largely ceased and more care is now being taken in the selection of breeding stock for the production of crossbred pullets. Obviously purely breed characteristics such as feather colouring are of no importance for such matings. On the other hand the poultry breeders and the hatcheries in the United Kingdom are giving full recognition to the importance of using high egg producing purebred stock for the production of crossbred pullets, on which the commercial egg producer depends for a livelihood.

Both livability and productivity are the most important characteristics of satisfactory crossbred pullets. To obtain these two characteristics in the progeny the purebred stock must have been bred for these two factors. This is an

An impressive unit of breeding pens on a large pedigree poultry farm in England. The labour involved in trapnesting and looking after birds in such a unit is considerable.

important fact that should be considered by poultry breeders in New Zealand, where the popularity of crossbred pullets for egg production is increasing every year.

Pedigree poultry farmers generally have not changed their methods of husbandry to any marked extent since before the war. Among a number of the old-established breeders the extensive and semi-intensive systems are still used. A later article will describe how the commercial egg producer has turned from these systems to the use of the intensive system. Some of the best known poultry breeders are occupying big areas of ground, including one on 100 acres and another on 50 acres. These breeders firmly believe in ample free range for growing stock, both cockerels and pullets, and furthermore aim to change their rearing grounds at regular intervals. This is one of the methods used to control disease and more particularly to prevent any outbreaks. From the stock seen on these farms in England it seems that this method of management is highly successful.

Similarly in Scotland accredited breeders are maintaining the semi-intensive system with fenced-in grass runs for adult stock and free range for growing stock. It was also noticeable that these breeders brooded their chicks in comparatively small units and all used floor brooding. One of the most successful breeders visited by the writer brooded all chicks in 100 units, using top heat from electric elements. These chicks were allowed out on to fresh runs as soon as the weather permitted. The average annual brooding losses over a number of years has not exceeded 2 per cent. and this low mortality over some 4000 chicks annually is indeed a highly satisfactory and creditable performance.

Breeding of Purebred Birds

Though even the top-ranking pedigree breeders appear to be involved in the production of crossbred chicks, there has been no falling off in the attention paid to the breeding of purebred birds. Poultry breeders in the United Kingdom are mainly carrying out full progeny testing on a family basis. The importance of the superior male and superior family (that is, group of full sisters) is fully recognised; formerly breeding from outstanding individual dams was the policy. Though it seems to be the policy of breeders to maintain a reasonable standard of bird according to breed characteristics, the main emphasis is on productivity and livability.

Production generally among purebred pedigree stock in the United Kingdom is appreciably higher than that being obtained in this country at present. However, poultry breeders in Britain put far more work into their breeding programmes, which involve a greater labour cost than is considered economic in New Zealand. If increased production is to be achieved in New Zealand, more work will have to be undertaken to obtain higher-quality breeding birds, but breeders prepared to tackle this problem of increased production will have to receive an increased return for the work involved. In the meantime under the conditions in New Zealand at present poultry breeders are obtaining a reasonable livelihood with a minimum of work on their breeding stock. Hand selection and mass mating of breeding birds involve far less labour and attention than is demanded by pedigree breeding as practised in the United Kingdom.

Meteorological Records for December

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in Inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	64.1	+ 1.4	82.1	46.1	3.41	11	— 0.44	0.77	11	234.2
Auckland	160	66.1	+ 2.4	77.3	54.3	5.56	11	+ 2.63	2.37	20	217.6
Tauranga	10	64.6	+ 2.5	78.3	49.2	5.54	13	+ 2.01	1.44	21	232.3
Ruakura	131	62.9	+ 2.2	78.5	46.3	5.03	10	+ 1.95	1.80	20	163.9
Rotorua	975	62.5	+ 2.5	78.5	45.6	6.69	12	+ 2.71	1.75	20	191.1
Gisborne	12	62.9	+ 0.2	87.2	39.8	8.05	13	+ 6.14	3.61	21	204.1
New Plymouth	160	61.4	+ 1.4	70.5	49.0	4.77	9	+ 0.18	1.54	20	200.6
Kariol	2125	57.7	+ 2.5	74.8	39.0	2.45	10	— 1.46	0.72	20	
Napier	5	64.0	+ 0.8	85.0	45.0	4.67	15	+ 2.69	2.69	21	208.5
Wanganui	72	63.1	+ 1.7	74.8	48.8	2.86	11	+ 0.00	0.67	20	211.1
Palmerston North	110	61.9	+ 1.5	78.6	40.8	2.40	14	— 0.88	1.34	20	172.4
Waingawa	340	60.8	+ 0.6	82.0	39.8	2.72	15	+ 0.21	0.63	10	170.1
Wellington	415	59.0	— 0.1	72.1	43.1	5.62	12	+ 2.16	1.72	20	187.2
Nelson airfield	5	61.7	+ 2.3	79.0	41.0	6.05	10	+ 3.21	1.60	9	244.6
Blenheim	12	61.6	+ 0.8	82.5	40.5	3.66	11	+ 1.66	0.71	20	222.2
Hokitika	15	58.7	+ 2.6	75.5	43.0	6.02	13	— 3.94	2.11	29	235.3
Hanmer	1270	57.1	— 0.7	86.0	36.2	11.59	14	+ 7.88	3.03	10	169.5
Christchurch	22	61.0	+ 1.2	86.2	45.1	2.61	14	+ 0.07	0.91	19	184.7
Ashburton	323	59.3	+ 0.2	88.0	40.6	6.49	14	+ 3.48	2.59	11	174.4
Timaru	56	59.6	+ 0.9	80.6	47.3	4.24	12	+ 1.58	2.14	10	157.6
Alexandra	520	62.0	+ 1.8	86.2	41.4	0.94	5	— 0.36	0.63	9	234.2
Taieri	80	55.4	— 0.6	79.1	37.4	3.48	18	+ 0.92	0.58	4, 10	163.4
Invercargill airfield	0	54.6	— 0.4	77.0	33.0	2.41	17	— 1.19	0.43	17	162.3

Reduction in Molybdenum Content of Molybdenised Superphosphate

THE Department of Agriculture's recommendations to manufacturers for the rate of incorporation of sodium molybdate in molybdenised superphosphate have recently been adjusted as the result of further research findings.

The rate of 11b. of sodium molybdate per ton of fertiliser in the North Island remains unchanged, but the rate for the South Island is to be reduced from 2lb. to 1½lb. on the basis of the material being 90 per cent. to 100 per cent. pure.

Farmers Should Get Advice of Instructor

The Department recommends that molybdenised superphosphate applications should not be made unless the farmer has the advice of the local Instructor in Agriculture that the area to be topdressed is deficient in molybdenum.

Rates of application should not exceed 2cwt. of the treated fertiliser per acre and should not be made more frequently than every second year.

Show Dates

THE following are dates and venues of A. and P. shows from March to mid-April:—

NORTH ISLAND

March

2 March—Morrinsville A. and P. at Morrinsville.
5 March—Albany A. and P. at Albany.
5 March—Waiotira Junction A. and P. at Waiotira.
*5 March—Mangonui County A. and P. at Kaitaia.
5 March—Waikato Central A. and P. at Cambridge.
5 March—Opotiki A. and P. at Opotiki.
*12 March—Whangaroa A. and P. at Kaeo.
12 March—Hawkes Bay A. and P. at Hastings.
12 March—Kumeu District A. and H. at Kumeu.
19 March—Wellsford A. and P. at Wellsford.

SOUTH ISLAND

March

4 and 5 March—Buller A. and P. at Westport.
*5 March—Temuka and Geraldine A. and P. at Winchester.
5 March—Amuri A. and P. at Rotherham.
*12 March—Mt. Benger A. and P. at Roxburgh.
12 March—Cheviot A. and P. at Cheviot.
*19 March—Upper Clutha A. and P. at Wanaka.
19 March—Mayfield A. and P. at Mayfield.
26 March—Hawarden A. and P. at Hawarden.
26 March—Methven A. and P. at Methven.

April

*2 April—Oxford A. and P. at Oxford.
11 April—Mackenzie County A. and P. at Fairlie.
11 April—Strath-Taieri A. and P. at Middlemarch.

* The Department of Agriculture exhibit will be staged at this show.

Cover Crops in the Home Orchard

THOUGH it is generally recognised that fruit trees can be grown in poor types of soil, the growth of trees and their cropping capacity are governed mainly by the fertility of the soil. Of the various means of increasing fertility and increasing the humus content of a soil one of the most valuable yet simple and economical methods within the scope of all home orchardists is the growing of cover crops. As a guide to selection various kinds of cover crops and their merits are discussed in this article by K. Stagg, Assistant to the Horticultural Superintendent, Department of Agriculture, Palmerston North. Other seasonal operations in the home orchard are also dealt with.

COVER crops can be grown either as annuals for turning under as green manure or as permanent cover crops and kept mown as a lawn. Either method is satisfactory and used intelligently is a means of making an orchard soil self-supporting in organic matter.

Annual Cover Crops

Advantages: The presence of a growing cover crop benefits a soil in several ways. It covers and protects the soil against adverse weather. It assists drainage by reducing the moisture content of the soil through the needs of the growing crop for water. The masses of root growth made by the crop prevent erosion and soil washing.

Plant foods which may otherwise be lost by leaching are used and conserved by the growing crop and later returned to the soil through decomposition. When turned under the cover crop builds up the humus content of a soil, makes the soil more friable, and increases its capacity to absorb and retain moisture, an important factor during dry weather.

Kinds of cover crops: The many crops that can be grown for turning under as green manure may be divided into groups such as legumes, cereals, grasses, and brassicas.

Legumes, provided they can be grown successfully, are preferable to other crops as, in addition to producing green material, they also add nitrogen to a soil through their ability to fix free nitrogen from the air in their root nodules. The legume blue lupin is probably the best known and most popular of all cover crops. A slow growing crop, blue lupin takes up to 20 weeks to reach a suitable stage for turning under. Under favourable growing conditions it attains a height of 3ft. to 4ft. and produces an immense bulk of vegetation. Blue lupin can be grown on most types of soil, but as the young plants are frost tender, it is advisable to sow early to allow plants to become well established before frosts occur. Other suitable legumes are broad red clover and white clover.

Cereals: Cereals rank next to legumes in popularity as green manure crops. Kinds more commonly grown are barley (Black Skinless and Cape varieties), oats (Algerian), and ryecorn (N.I.A.B.). All are easy to establish and capable of producing a quick growing bulk of green material. Oats and ryecorn can be grown on a wide range of soils, but barley prefers a medium to good quality soil.

Brassicas: With the exception of mustard, brassicas are not suitable for orchard conditions. Like most other brassicas mustard prefers a fairly rich soil. Once established it makes rapid growth and is ready for turning under before most other crops. The growth made is soft and sappy and decomposes very rapidly.

Grasses: Though grasses are not grown as extensively for green manures as other crops, Italian ryegrass has a definite place as an orchard cover crop. Easy to establish, Italian ryegrass has the advantage that it can be sown later than most other crops, usually during March or April. Other features are its dense, rapid growth which, combined with the masses of root growth produced, hastens decomposition. Italian ryegrass can be grown on most types of soil and is noted for its hardiness to winter conditions. Other grasses which are suitable are short-rotation (H1) ryegrass and prairie grass.

Sowing the Cover Crop

Cover crops may be sown successfully during spring and autumn, but to be of benefit in the home orchard the crop should be grown at a time when it does not compete with fruit trees for plant foods and moisture. In a normal season the most suitable period for sowing the seed is during February and early March. However, the time of sowing will be influenced by prevailing growing conditions. During seasons of adequate rainfall and when sufficient moisture is available for the needs of the tree seed may be sown in February, but under drought conditions sowing should be delayed until there has been sufficient rain. Before sowing the soil should be worked to a fine tilth and firmed. After sowing it should be raked lightly to cover the seed.

Fertilisers: On most types of soil phosphatic fertilisers are necessary to produce good cover crops and an application at the time of sowing is recommended for all crops. When grasses and cereals are grown an application of sulphate of ammonia also is necessary for quick establishment.

Rates of seeding and fertilisers which will give satisfactory results under normal conditions are given in the table on the next page.

Turning the Crop under

Quick-growing crops, such as mustard, can be turned under sooner than can slower-growing crops, such as blue lupin. For best results the crop should be turned under before it reaches maturity, preferably while it is still growing strongly. At this stage the plant tissue is soft and decay will be more rapid.

The most satisfactory method of turning the crop under is to rotary hoe it or chop it up and dig it in to incorporate the green material in the top layer of soil. Trenching or burying of the crop in thick layers prolongs decomposition and is not recommended.

Cereal crop in a commercial orchard ready for turning under as green manure.

RATES OF SEEDING AND FERTILISERS FOR COVER CROPS

Seed and fertiliser	Sowing rate per acre lb.	Approximate sowing rate for small areas
Legumes:		
Blue lupin	120	1oz. to 3 sq. yds.
Broad red clover	10	1oz. to 30 sq. yds.
White clover	5	1oz. to 60 sq. yds.
Superphosphate	224	2oz. to 3 sq. yds.
Cereals:		
Barley	60	1oz. to 6 sq. yds.
Oats	60	1oz. to 6 sq. yds.
Ryecorn	60	1oz. to 6 sq. yds.
Superphosphate	224	2oz. to 3 sq. yds.
Sulphate of ammonia	112	1oz. to 3 sq. yds.
Brassicas:		
Mustard	6	1oz. to 60 sq. yds.
Superphosphate	224	2oz. to 3 sq. yds.
Grasses:		
Italian ryegrass	30	1oz. to 10 sq. yds.
Short-rotation ryegrass	30	1oz. to 10 sq. yds.
Prairie grass	40	1oz. to 8 sq. yds.
Superphosphate	224	2oz. to 3 sq. yds.
Sulphate of ammonia	112	1oz. to 3 sq. yds.

While decomposition of the cover crop is taking place a temporary nitrogen deficiency may occur in the soil. It is important, therefore, to turn cover crops under at least 6 weeks before tree growth begins.

Permanent Cover Crops

In home orchards in New Zealand permanent grassing down is a comparatively new system.

Permanent sward in orchards has been studied in England for many years and is now being tried in commercial orchards in New Zealand. The principal advantage of a grass sward in an orchard is that of soil improvement. Most New Zealand soils are improved by the addition of organic matter. Unfortunately continual cultivation speeds the depletion of humus in the soil and so offsets much of the good done by turning under annual cover crops. Permanent grassing down of an orchard eliminates cultivation and thus removes one of the main causes of humus depletion. Permanent sward therefore tends to increase the organic content of the soil to a greater extent than can be done by annual cover crops.

Other benefits from grass in orchards are the prevention of erosion and rapid run-off after heavy rain, improvement of drainage, and elimination of cultivating work, though this saving is somewhat offset by the need for frequent mowing. The growth of overvigorous trees may be checked and the trees brought to a productive state by allowing the grass to grow unchecked and compete with the trees for plant food and moisture. Grass also provides cooler and more pleasant conditions in the orchard in summer.

However, despite all these advantages grassing an orchard should be approached with some caution. The grass competes with the fruit trees for soil moisture and plant food, and until more is known of the effects of grass in orchards in areas having dry summers it may be desirable to confine grassing down to districts which have reasonably good rainfall during summer.

Sowing

Grass should not be sown permanently in the orchard until trees are at least 5 years old and well established. It is desirable that soil conditions and fertility should be sufficient to ensure the establishment of a good sole of grass. Before the grass is sown the soil must be worked to a fine tilth, levelled, and consolidated to provide a good surface for mowing.

A suitable seed mixture is 30lb. of Certified browntop and 5lb. of Certified white clover to 1 acre or 10oz. of browntop and 1oz. of white clover to 60 sq. yds. The seed should be sown during March or early April with 2cwt. of superphosphate and 1cwt. of sulphate of ammonia per acre or the same fertiliser mixture at 1oz. per square yard.

Maintenance

The essential points in successful management of pasture in orchards are frequent mowing and use of adequate fertiliser, particularly nitrogen.

During late autumn and winter it is desirable to let the grass grow up to 6in. long, but from the time the trees begin growth the grass should be mown when it reaches a height of 4in. To reduce loss of moisture through transpiration by the grass mowing should be more frequent during dry weather and the grass should be kept short.

Grassed orchards need more fertiliser than do cultivated orchards. The general fertiliser application should be increased by about 20 per cent. and in addition 1lb. or 2lb. of sulphate of ammonia or other nitrogenous fertiliser per tree should be applied in early spring.

An orchard should not be grassed unless frequent mowing can be done, especially during the dry months. Additional nitrogen is essential.

Seasonal Work

Citrus: During February and March citrus trees should be inspected regularly for scale and other insect pests. As infestation is not always confined to the fruit, careful examination of wood, foliage, and fruit is necessary. A sure indication that mealy bugs, aphides, or scale insects are present is the appearance of a black sooty film on the foliage and fruit. To control all insect pests trees should be sprayed with summer oil and nicotine sulphate (1 pint and 5 teaspoons respectively to 4 gallons of water) in early February and 3 to 4 weeks later. Later summer oil (½ pint to 4 gallons of water) should be applied.

Strawberries: Strawberry beds for autumn planting should be prepared now to allow the soil to settle before the plants are set out. The area selected needs to be well drained or alternatively raised to allow free drainage, as wet conditions cause root rot.

Strawberries are gross feeders and prefer a soil rich in humus. Before planting a base dressing of manure consisting of 3 parts of blood and bone, 3 parts of superphosphate, and 1 part of potash, all by weight, should be applied at 4oz. to 8oz. per square yard.

Harvesting and Storage of Apples and Pears

Apples and pears required for storage should not be harvested until fully mature. As fruit on the higher outer parts of trees matures before fruit on the inside and lower down, several pickings may be necessary to obtain fruit of suitable maturity. After harvesting, the fruit should be sorted carefully into large, medium, and small and any diseased or damaged fruit should be discarded. The fruit should be left outside overnight to cool. Fruit of each size should then be placed in separate boxes lined with newspaper or other suitable material and stored in a cool position. Cases should be stacked so that air can circulate around each of them.

Budding

Citrus, pip, and stone fruit trees may be budded during the following periods:—

February: Citrus, apples, pears, plums, and quinces.

Mid-February to end of March: Peaches and nectarines.

Budwood should be collected from only mature, disease-free trees of proved and consistent cropping habits, as buds inherit characteristics of the parent plants. Time of budding depends on the sap flow in the stock; if the bark does not lift readily, budding should not be attempted. If drought conditions have been experienced and the bark is hard to lift, the tree should be watered thoroughly to induce the sap to flow.

The art of budding was described and illustrated in the article "Home Orchard in Autumn" in the February 1954 issue of the "Journal".

Research Work on Maturation of Grapes

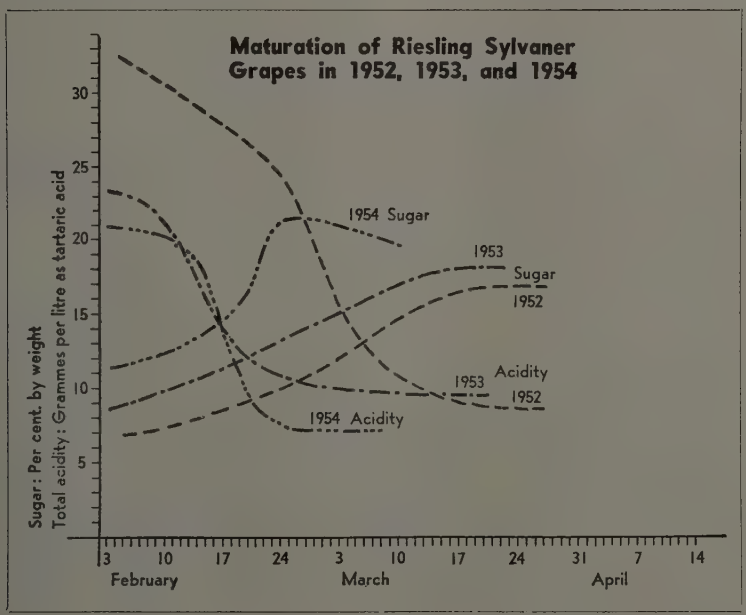
DETERMINATION of the time of harvesting grapes has always been an important problem of the grape grower and wine maker. Grapes which are harvested unripe will never make palatable wines, and when marketed as table grapes they will not be appreciated by the public because of their harsh acidity and lack of flavour. During the last 3 years observations were made at the vineyards of the Department of Agriculture's Te Kauwhata Horticultural Research Station to determine the optimum maturity point of 20 grape varieties, and results of this work to date are given in this article by D. S. Kasza, Viticulturist at the Station, to assist growers in deciding when to harvest their grapes.

Riesling Sylvaner grapes, one of the two varieties tested. [*Sparrow*

RIPENING of grapes begins when the berries are almost fully grown and, changing their colour, become more or less translucent. This stage is called the "veraison", and the acid content of the grapes up to this point is mostly a mixture of free tartaric acid and malic acid. After the veraison acidity decreases as a result of the oxidation and elimination of some of the malic and tartaric acids. Because malic acid is a less stable acid than tartaric acid, it is oxidised and reduced to a greater extent than tartaric acid in ripening. This is all to the good for wine making, as malic acid is a harsh acid and its presence in large amounts will give an objectionable sharpness to the wine.

As ripening progresses the acidity of the grapes is further lowered by the transfer of potash salts to the berries and the free tartaric acid is partly neutralised to form potassium bitartrate.

In hot wine making countries malic acid is almost completely removed by oxidation and the tartaric acid is reduced to a low level, what remains being nearly all converted to potassium bitartrate. (In such circumstances the acid content of the grapes may be so deficient as to require the addition of tartaric acid or citric acid to make a balanced wine.)



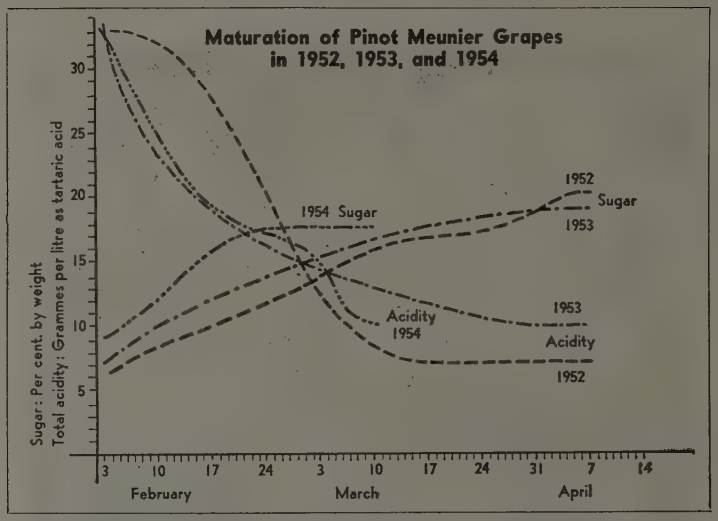
Maximum Maturity Desirable

In the cool climate of New Zealand and other countries with a temperate climate, like Germany, Switzerland, and the northern provinces of France, the position is reversed and at full maturity the grapes contain a considerable quantity of malic acid and free tartaric acid. Because of this the importance of permitting the grapes to attain maximum maturity for the reduction of acidity can be readily appreciated.

When the grapes approach maturity the steady fall in their total acidity will stop and acidity will become stable. At the same time the sugar content, which was increasing during the maturation, will also reach a point when it will not rise any more.

Trials with Two Varieties

The two diagrams in this article show the changes in sugar and total acid content of the must of ripening Riesling Sylvaner and Pinot Meunier grapes. It is interesting to note the variations of the ripening in 1952, 1953, and 1954.



To produce the maturation curves 11b. random samples were taken from each grape variety at approximate weekly intervals. The sugar and total acid contents of these samples were analysed and the results were put on the graphs. The curves show clearly the increase in sugar and the decrease in total acidity. Sugar content is expressed in per cent. weight, and total acidity in grammes per litre as tartaric acid.

The Riesling Sylvaner graph shows the great difference in maturation in 1954 against 1953 and 1952. The sugar and acidity curves indicate a faster and more perfect maturity in 1954 than in the previous 2 years. The improvement in the maturity, and consequently also in the quality, was due to the fact that from 1 February 1954 the Riesling Sylvaner grapes were protected from birds with wire netting. No grey rot (*Botrytis cinerea*) damaged the netting-protected grapes in spite of heavy rains and high humidity in early March.

Essential Conditions for Colouring and Flavouring

Maturation of grapes will not be complete without development of the colouring and flavouring substances. The pigments of red and black grapes are formed in a colourless state in the leaves whence they are conducted to the berries. Here they change into the coloured form (pigment) by oxidation. This process requires both air and a certain amount of heat. Thus with table grapes it may be necessary to remove a few leaves around the bunches so that they should not be completely shaded. Too heavy defoliation, however, is harmful as it deprives the vine of its assimilating surface. If the weather becomes suddenly hot and dry, heavy defoliation may result in a "cooked" flavour in the grapes, or, as happened in several vineyards in 1951, it may cause wilting and partial loss of the crop.

The aromatic substances are also formed in the leaves and, after the veraison, pass into the pulp and skin of the berries. In addition the grape contains substances which during the alcoholic fermentation undergo chemical changes and yield the bouquet-giving substances. Without these the wine would be flat and insipid.

Weather Factor

All these points underline the desirability of delaying the harvesting of grapes until they are fully matured. There is, however, a factor which cannot be neglected—the weather.

After the veraison the growth of the vine almost stops. If rain then falls after a period of hot, dry weather, the berries swell considerably, and some varieties, for example, Gloriod and Baco 1, can easily crack. This is due to the greatly increased pressure inside the berry caused by the absorption of a large quantity of water. The increased sugar content favours this absorption of water.

Heavy rainfall or extensive bird damage in this period is also favourable to the development of grey rot. This fungus finds an ideal medium in the sugary juice of the cracked berries and in a few days it may envelop the whole bunch with its grey mould, rendering the fruit unfit for sale or use. Wine made from mouldy grapes may have an unpleasant flavour and is apt to undergo darkening and breaking of colour. In extremely bad weather the whole crop may be jeopardised by grey rot and in such circumstances the grower has to save the crop even at the expense of quality.

Sugar and Acidity Tests

Apart from such exceptional cases, however, it is advisable to harvest the grapes as near to full maturity as possible. To determine when the grapes are ready to harvest tests should be made for sugar and total acidity.

Sugar can be tested either by the gravimetric method, that is, with the help of the Beaume hydrometer, or by a pocket refractometer. The total acidity is determined by titration with N/10 sodium hydroxide solution (caustic soda) in the presence of either phenolphthalein indicator or litmus paper.

The accompanying maturity graphs show that as the season advances sugar content of the grape increases and acidity decreases. The time of optimum maturity when maximum sugar and minimum acidity are recorded varies from year to year and the ratio of sugar to acidity also varies. For these reasons the ratio of sugar to acidity cannot be accepted as a standard, and testing at weekly intervals each year is necessary because no fixed date can be accepted as a reliable guide to maturity.

If grape growers for any reason are unable to carry out both sugar and acidity tests, they will get a fairly accurate estimate of maturity by making the sugar test only, because in most seasons maximum sugar and minimum acidity figures are reached at approximately the same time. Baume tests for sugar may be made, but the simple pocket refractometer may be used with quite satisfactory results for direct testing in the field. A drop of juice is placed between the glass prisms of the instrument, which is then held up to the light and the sugar concentration read on the scale through the eye piece.

It is also recommended to leave the fruit on one or two vines of each variety after the harvest to see how long it is possible to keep the grapes undamaged. This observation, if carried through several years, will facilitate the determination of the harvesting dates of different varieties.

The danger of botrytis damage can be avoided only by the selection of resistant grape varieties which have a fairly thick skin and a loose bunch. Early maturing varieties with a characteristic flavour like the Riesling Sylvaner, Palomino, Golden Chasselas, and Seibel 5409 among the whites, and the Pinot Meunier, Seibel 5163, and Seibel 7053 among the reds are desirable.

At present research work is being carried out at the Te Kauwhata Horticultural Station and it is hoped that in a few years more varieties with desirable characteristics will be selected and made available to the public.

Wheat Growing in Canterbury

OVER the past 10 to 15 years much has been written about wheat growing in New Zealand. Many writers in publications and articles have dealt adequately with varieties, control of diseases, and recommended growing practices. In this article by W. V. Hadfield, Agronomist, Department of Agriculture, Timaru, wheat growing is discussed largely in relation to soil fertility and the influence of soil types on cultivation practices, crop rotations, varietal distribution, and crop yields.

CANTERBURY wheat growing soils exist under a rainfall range of 20in. to 35in. per annum and fall into the group of soils known as the yellow-grey earths, which are derived largely from greywacke parent material. In the North Island this group of soils is fairly extensive in Hawkes Bay and Wairarapa, and both these districts have in the past contributed materially to the New Zealand wheat acreage.

Within the confines of the yellow-grey earths are many different soil types varying in fertility according to their age and their proximity to the major rivers. Along the south banks of the main rivers of Canterbury are scattered areas of recent alluvial soils of high fertility. Generally the further that soils are removed from the comparatively recent influence of the major rivers the more weathered and leached they have tended to become. They are often stony or bouldery with very little topsoil and subject to droughts. Their fertility status consequently is not high. These soils constitute the light wheat land of Canterbury. Under irrigation, however, improved pastures and heavier stocking are possible and fertility can be so improved that good average crops of wheat can be grown.

Heavy wheat land is found extensively along the lower reaches of the main rivers where silt has been deposited from periodical flooding. These areas extend in the Christchurch area from Kaiapoi to Leeston. Other localities are along the lower reaches of the Ashburton River in mid-Canterbury and in the Temuka and Studholme-Morven districts of South Canterbury. These soils are capable of heavy yields of wheat on all but the most poorly drained areas.

In North and South Canterbury are the rolling downlands soils, which are quite distinct from the plains soils. They are of moderate fertility, and wheat yields fall midway between those of the heavy and light soils mentioned earlier. These soils are responsible for good average crops of wheat and constitute the bulk of the medium wheat soils of Canterbury.

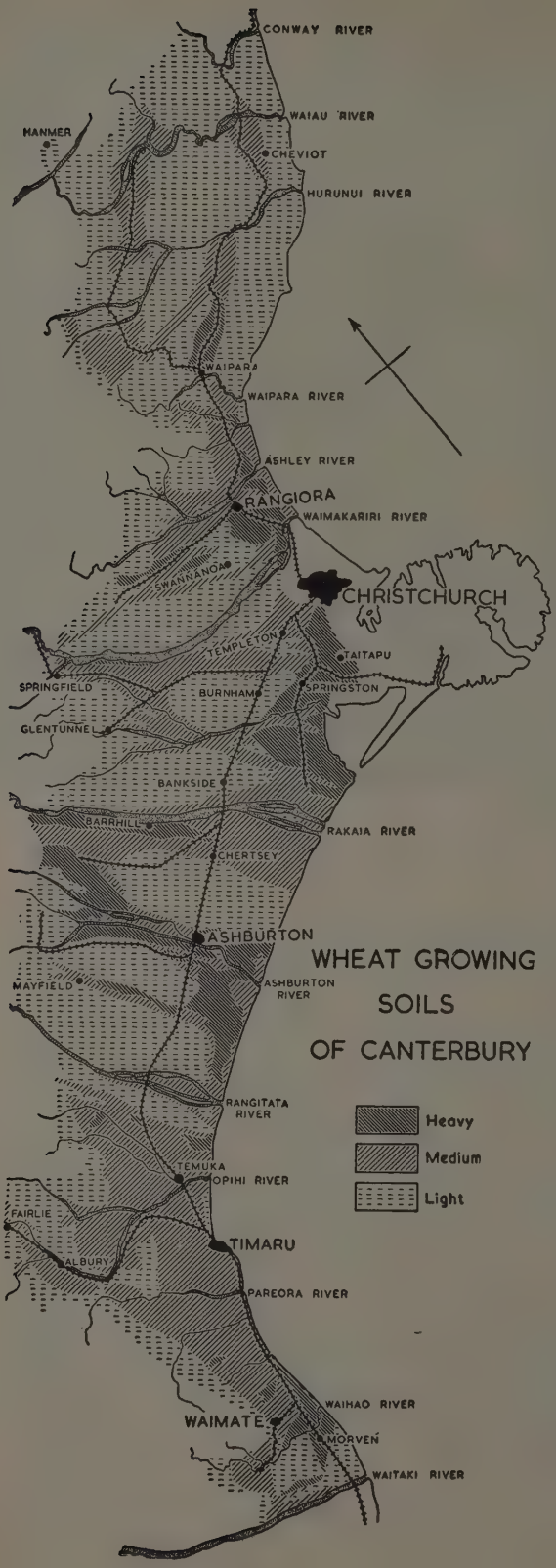
It is thus possible to group the Canterbury wheat growing soils into three broad classifications on the basis of their wheat yielding capacity. In the map on page 162 the main wheat growing areas are grouped into heavy, medium, or light wheat land according to yield. Heavy wheat land is confined to those soil types yielding 50 bushels per acre and over, medium wheat land is that yielding between 35 and 50 bushels per acre, and light wheat land is that yielding below 35 bushels per acre.

Soil Types

Heavy Wheat Land

Some of the heavy yielding wheat soils are recent alluvial soils. Others are classed as "meadow" soils of high fertility developed as a result of silt deposits. Generally

HEADING PHOTOGRAPH: An aerial view of the Canterbury Plains, one of the most important wheat growing areas in the Dominion. V. C. Browne photograph.



these are silt loams or sandy silt loams over silty to clayey subsoils. Farming on them is largely confined to dairying and mixed cropping. In the past, lack of adequate drainage on some of these soil types has been one of the factors limiting the production of wheat.

The Taitapu series of soils is found mainly to the south of Christchurch in the Taitapu-Springston-Halswell area and also south and east of Rangiora. The Wakanui series is found close to the Taitapu soils and also in an extensive area south of Ashburton to the coast. Small areas are also found near Rangiora and Temuka. Both these series of soils are of high fertility, their composition varying from silt to peat and clay loams over subsoils ranging from sand to silt and clay. On the whole the Wakanui series is more easily worked and wheat is more extensively grown on it than on the Taitapu series. Artificial drainage is necessary on both these soils, though on the more poorly drained areas wheat cannot be grown successfully.

The Barrhill series, found in the Barrhill district along the south bank of the Rakaia River, is well drained and easily worked, having a sandy subsoil. It is confined to intensive cropping of wheat, peas, and potatoes. Other heavy yielding wheat soils are the Omihi series found north of Waipara in North Canterbury. These are heavy silt loams formed on a calcareous parent material with a high lime content, and are very fertile and grow wheat extensively. In the Waimate area the Willowbridge silt loams are dark grey silt and sandy loams of good fertility and are confined largely to potato growing. In and around Willowbridge, Morven, and the Waihao River are the Pukeuri and Morven soils, which are brown-grey silt loams of good depth over subsoils of heavy silt loams. Wheat is grown on these fertile soils, and along with potatoes is regarded as the principal cash crop. Drainage is a problem on some of these soils.

Medium Wheat Land

Most of Canterbury's wheat is grown on the medium wheat land, and over half the area of Canterbury suitable for wheat growing falls into this category. Within this group is a wide range of soil types, many of which merge into either the heavy or the light yielding wheat soils. The medium wheat soils can be broken down to two further broad subdivisions, the plains soils and the downlands soils.

The soils of the Canterbury plains are largely recent to immature soils confined either to scattered areas in the vicinity of the major rivers or in larger areas developed as a result of river flooding and the deposition of dust from the river beds. They include the more fertile soils of the Paparua, Templeton, Hatfield, Chertsey, and Waimakariri series, which exist as scattered areas largely along the south banks of the Waimakariri and other rivers. The Lyndhurst series is confined to strips of land to the south of the Rakaia and Waimakariri Rivers and is probably the furthest removed of the medium soils from the influence of these rivers. Consequently the soils of this series are slightly more leached than the recent soils. They are silt loams with a similar subsoil over stones and are of moderate fertility. Generally the medium plains soils are sandy to silt loams of a depth of 18in. to 24in. over stones. Soils are of moderate fertility, easily worked, and free draining, but are prone to droughts. They respond well to lime and phosphates. Mixed farming is the main type of farming practised on these soils.

The downlands soils occur extensively in North Canterbury north of Rangiora, in South Canterbury west of Temuka, Timaru, and Waimate, and along the foothills of the main divide. They are formed on deposits of windblown silt derived from the greywacke mountains to the west and known as loess. Mixed farming is practised on them, and on some wheat fits into the cropping programme. Topography ranges from easy rolling to hilly, with a range in altitude from sea level to more than 1000ft. near the foothills.

The soils are essentially pan soils with a topsoil of friable silt loam and mottled subsoils of compact silts, sandy silts, or clays. These soils are more difficult to cultivate than the plains soils and drainage is impeded by the presence of the pan. Soils are of moderate fertility and give a fairly good lime response, particularly on the Ashley soils of the foothills, where the rainfall is around 30in. to 35in. The soils are generally poor in structure. The Timaru series, found extensively behind Timaru, is the most fertile of these soils. The Taiko and the better soils of the Claremont series are similar but are of lower fertility and have a poorer structure. In North Canterbury

A 43-acre paddock of Cross 7 wheat. Cross 7 is now the most widely grown wheat variety in Canterbury.

the Ashley soils are quite extensive and the Cheviot soils, which are of higher fertility, grow some wheat.

Light Wheat Land

Farming on the light wheat land is confined mainly to sheep grazing with a little cropping on the best of the soils. The light land soils are the most distant of all the groups from the influence of the main rivers, and consequently are older and more leached. They occur on the major river fans of the Canterbury Plains. Their occurrence is extensive to the north of the Waimakariri River, north-west of Burnham, between the Orari and Rangitata Rivers, and north of the Waitaki River. The Lismore series, which are shallow stony silt loams over stones, are the most extensive of the light land soils. Some are too shallow and bouldery for cultivation and all are subject to droughts, and only a little wheat is grown on them. The Ruapuna series near Mayfield and Staveley grow a little wheat. They are similar in many respects to the Lismore soils, but though they have a higher rainfall, they are not so fertile. The Eyre soil series found north of the Eyre River, near Swannanoa in North Canterbury, and north of the Rakaia River, near Bankside, grow a little wheat. They are also shallow stony silt loams.

Some wheat is grown on the poorer of the downlands soils which can be classified as light land wheat soils. They are those of the Glenroy and Skipton soils situated around Glentunnel and south of Springfield, and the Opuha soils around Fairlie and Aldbury in South Canterbury also grow a little wheat. The latter are silt loams similar in character to the Glenroy soils but of poor structure and drainage and of low fertility generally. They occur extensively along the foothills south of the Rangitata River.

Distribution of Wheat Acreage

An estimate of the relative areas of light, medium, and heavy land capable of growing economic crops of wheat is given in Table 1.

TABLE 1—AREAS OF LAND CAPABLE OF GROWING ECONOMIC WHEAT CROPS

	Acres	Per cent.
Light land	479,000	29
Medium land	939,000	57
Heavy land	229,000	14

A wheat survey covering the 1951-52 and 1952-53 seasons showed that the Canterbury wheat acreage was distributed over the 3 main wheat growing soils approximately as in Table 2.

From Table 2 it can be seen that the majority of Canterbury's wheat is grown on the medium wheat yielding soils and less than 10 per cent. is grown on the light land.

Over the 2-year period the greatest area increase has taken place on the medium wheat land, which offers by far the greatest scope for any great increase in wheat sowings.

TABLE 2—DISTRIBUTION OF WHEAT ACREAGE IN 1951-52 AND 1952-53 SEASONS

	Wheat area 1951-52	Per cent. of total wheat area	Wheat area 1952-53	Per cent. of total wheat area	Increase in wheat acreage 1952-53 over 1951-52
	acres		acres		acres
Light land ..	4,500	9	7,000	10	2,500
Medium land ..	38,300	72	48,900	68	10,600
Heavy land ..	10,200	19	15,400	22	5,200
*Totals ..	53,000		71,300		18,300

* These totals are an estimate used for the purpose of the survey and do not necessarily correspond accurately with the area harvested.

The 1952-53 figures for area in wheat on each of the three classes of wheat land show that the heavy wheat land is contributing proportionally more to the wheat acreage than are the other two classes. This is illustrated in Table 3, which shows the wheat acreage on each of the three classes of land as a percentage of the total of each class.

TABLE 3—PERCENTAGE OF LAND CLASSES USED FOR WHEAT

	Total area available	Area in wheat 1952-53	Area in wheat as percentage of total area (approximate)
	acres	acres	
Light land ..	479,000	7,000	1.5
Medium land ..	939,000	48,900	5.2
Heavy land ..	229,000	15,400	6.7
	1,647,000	71,300	4.3

During the peak year 1942-43, when the Canterbury wheat area reached approximately 211,000 acres, the over-all percentage of Canterbury wheat land growing wheat was approximately 12.9 per cent. compared with the figure of 4.3 per cent. for 1952-53.

If any great increase in wheat area is to occur, the greatest scope is obviously on the medium land. Even if only the medium land were to come up to the over-all average of 12.9 per cent. obtained in 1942-43, the present Canterbury wheat acreage would be doubled.

Wheat Varieties

Cross 7

Cross 7, now the most widely grown of all wheat varieties, is a cross between Solid Straw Tuscan and White Fife, and was bred by the Wheat Research Institute. It was first put into production in 1935-36, and rapidly replaced Solid Straw Tuscan as the most favoured variety. Its main

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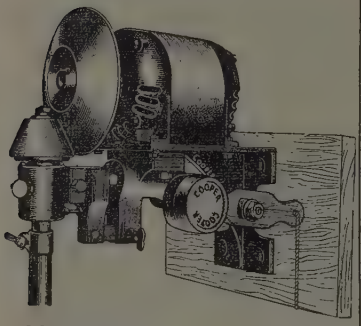

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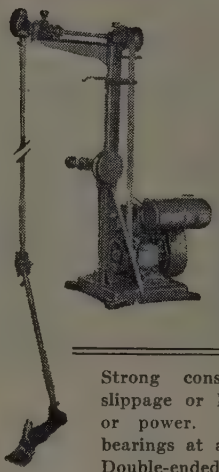

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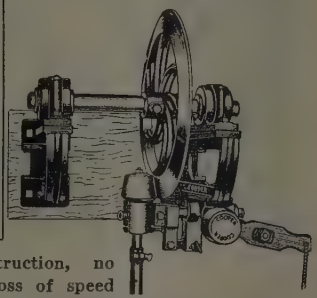

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attributes are its ability to withstand lodging and its tolerance of heavy winds without undue shattering. It ripens evenly and lends itself admirably to direct heading. Cross 7 is a variety which can adapt itself to a wide range of soil types and climatic conditions and is therefore an excellent all purpose wheat. Cross 7 grain gives a higher flour extraction and has a higher baking quality than Solid Straw Tuscan, and for these reasons is favoured by both millers and bakers. In less than 10 years after its introduction Cross 7 had become the most widely grown variety. Even since 1948 the percentage of Cross 7 grown has shown a gradual upward trend, as seen in Table 4.

TABLE 4—AREA OF CROSS 7 WHEAT AS A PERCENTAGE OF CANTERBURY WHEAT ACREAGE

	1948	1949	1950	1951	1952
	per cent.	per cent.	per cent.	per cent.	per cent.
Cross 7	66	73	76	78	81

Cross 7 wheat is grown on all three wheat growing soils, though on the very low wheat yielding soils Fife Tuscan is grown to a greater extent. Generally on heavy wheat yielding soils Cross 7 is the main variety grown, though Hunters and Dreadnought varieties have an important role and in some districts are the dominant varieties.

Fife Tuscan

After Cross 7 had proved itself superior for the medium and heavy wheat soils Solid Straw Tuscan found itself relegated to the role of a light land wheat. Its place has now largely been taken by Fife Tuscan, which is the second most important variety in Canterbury and is a comparatively new wheat bred by the Wheat Research Institute to replace Solid Straw Tuscan as a light land wheat. Like Cross 7, Fife Tuscan is the result of a cross between Solid Straw Tuscan and White Fife, though it more closely resembles Solid Straw Tuscan. It has the advantage of a higher yield and a greater resistance to "loose smut" than has Solid Straw Tuscan, though its baking quality is much the same. Over the last 3 years Fife Tuscan has contributed about 10 per cent. of the total Canterbury wheat acreage, while the Solid Straw Tuscan area has dwindled down to just over 2 per cent.

Over 65 per cent. of the Fife Tuscan acreage is in Ashburton County, where it is grown extensively on the Lismore series of soils, which are essentially shallow stony silt loams. These soils exist also in Malvern County, and here Fife Tuscan is also grown in quantity.

Dreadnought

Dreadnought is probably the highest yielding of the common wheat varieties grown in New Zealand. It is best suited to heavy land, where, in spite of its hollow straw, it stands up reasonably well, but it has the serious disadvantage of being susceptible to shattering, and strong winds as the crop reaches maturity may cause a serious loss of grain. For this reason it is confined mainly to the fertile soils around Waimate and Morven, a locality not as subject to strong winds as are other parts of Canterbury. It is not usually suitable for direct heading, as the heads do not ripen evenly, and it is usual for the crop to be windrowed and threshed with the pick-up header. The baking quality of Dreadnought wheat is reasonably good.

During the last 3 years the area of Dreadnought wheat in Canterbury has been about 5 per cent. of the total wheat acreage. Apart from a few hundred acres grown on the heavy soils of the Ellesmere district practically all the Dreadnought wheat grown in Canterbury is found on the heavy silt loam soils around Waimate and to a smaller extent on the best of the downlands soils of Waimate County.

Hilgendorf

Hilgendorf is a new variety bred by the Wheat Research Institute from a cross using Cross 7 and Tainui as parents. Its main virtue is its markedly superior baking quality. It is short strawed and because of its short stocky head does not look very attractive. It is slightly lower in yield than Cross 7, but is earlier maturing. Its lower yielding ability is more noticeable on light wheat land, and it is probably best suited to the medium wheat soils.

Yielder

Yielder is the most recent of the locally bred wheats to be put into commercial production. It is heavier yielding, a little earlier maturing, and of similar baking quality

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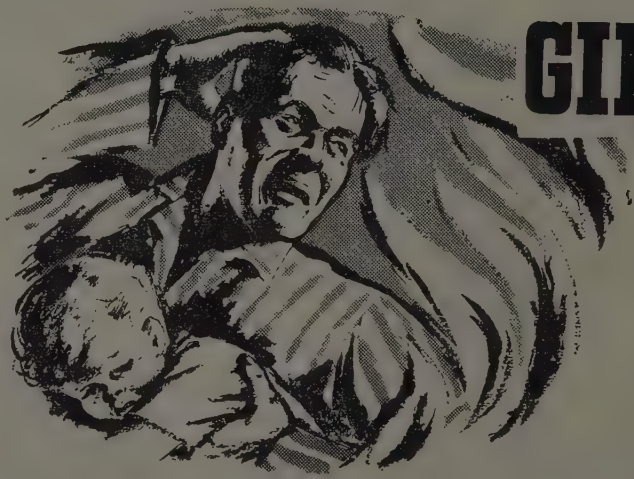

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A wheat trial being conducted at the Wheat Research Institute, Lincoln. A number of the main wheat varieties grown in Canterbury, including Cross 7, Fife Tuscan, and Hilgendorf, were bred by the Wheat Research Institute.

to Cross 7. Its main disadvantage is that it does not withstand lodging as well as does Cross 7, but in spite of this it is considered to be a direct heading wheat.

Hunters

Hunters, which is a heavy land wheat, has gone out of popularity, and less than 1 per cent. of the wheat grown in Canterbury is of this variety. Because it does not lend itself to direct heading, its place has been taken largely by Cross 7. Hunters is a heavy yielding wheat and is not affected by loose smut.

Crop Rotations

The farming pattern throughout Canterbury is considerably influenced by the inherent fertility of the predominant soil types. To a large extent crop rotations vary according to both soil type and soil fertility. As fertility is improved so cropping rotations can be changed. For example, much of the light plains land of Canterbury has been improved by better grasses and heavier concentrations of livestock to the extent that it can now include wheat in the rotation. Similarly, some of the heavy land soils which have been drained are now growing wheat. Economic changes, too, can cause alterations in accepted crop rotations. In parts of Canterbury, for example, where linen flax and linseed a few years ago played an important part the slackening demand for these crops has necessitated an alteration in cropping programmes. Also in some districts there appears to be a traditional local preference for certain rotations peculiar only to those districts.

Though it is not easy to define typical rotations because of these factors, predominant rotations are apparent on some types of soils.

In the broad division of wheat growing soils in Canterbury wheat follows grass in the rotation on the heavy land but on the medium land the brassica-wheat rotation is nearly as common as that of grass-wheat. On the light land wheat frequently follows a fed off brassica crop.

There are variations from these general rotations in some areas, and on the medium land on the plains and the heavy yielding but easily worked soils around Barrhill and Methven peas are a common crop and the grass-peas-wheat rotation is popular. Potatoes are also grown on some of these soils, which include the Rakaia, Templeton, Hatfield, and the best of the Paparua and Waimakariri soils, and here the grass-potatoes-wheat and grass-brassica-potatoes-wheat rotations are found. On the medium soils of the Timaru downs and similar soils wheat commonly follows a brassica crop.

In South Canterbury on the heavy land of the Waimate-Morven district potatoes are probably the most important cash crop, and here wheat frequently follows potatoes. On the heavy land on the plains rape or peas may be the first crop after grass and may be followed by wheat and then either barley or a second crop of wheat before the land is sown to grass again.

On the light land of the plains the grass-rape-wheat rotation is common as also is fallow followed by sowing down to grass or greenfeed-fallow followed by sowing down to grass.

Confirmation of a number of these rotations was obtained from the results of a survey of wheat crops carried out in 1953 over several hundred crops selected at random but representative of the three wheat growing land classes.

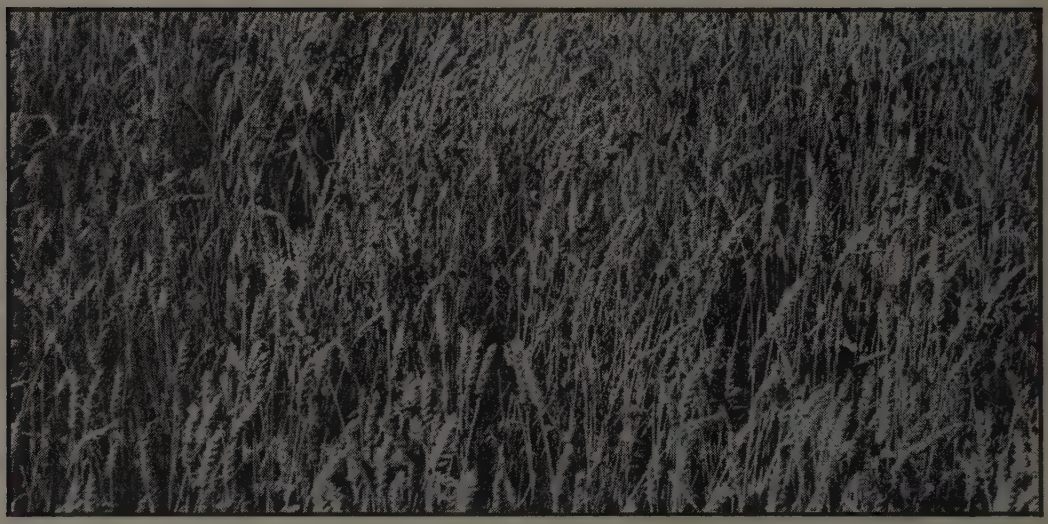
Cultivation Practices

It is virtually impossible to present a list of standard cultivation practices for the preparation of wheat land. The various operations naturally vary according to the nature of the soil, previous crops, weed content, and above all the vagaries of the weather.

In the preparation of wheat land after grass it is obvious that considerably more cultivating operations are likely to be required than after a crop such as peas or a fed off brassica crop.

On medium to heavy land the preparation of wheat ground after a grass pasture necessitates the bulk of the cultivation before deep ploughing. The first operation is to skim plough the top 3in. in early autumn. Over the following 6 to 8 weeks the turf may be given one or two discings or grubbings, or in some cases a combination of both, before it is harrowed with the heavy harrows. By this time the turf should be sufficiently broken down to ensure adequate consolidation at the bottom of the furrow after deep ploughing in early winter. A discing and a harrowing would probably follow the ploughing, and by this time the seed-bed would usually be in a good rubbly state suitable for drilling wheat. It is common to harrow the drilled surface in order to cover the seed by attaching a set of light harrows to the back of the drill.

On very heavy land or under high rainfall conditions it is sometimes the practice to "sow on the one furrow",



Cross 7 wheat ready for harvesting. The main attributes of Cross 7 wheat are its ability to withstand lodging and its tolerance of high winds without undue shattering.

that is, to deep plough the pasture without any preliminary cultivation. The furrow is then worked down to a suitable seed-bed with the necessary implements. On the lighter soils if wheat is to be grown after grass, the skimmed surface may be given one or two grubbings rather than discings if the area is stony. After harrowing and a rolling the paddock is deep ploughed, and subsequent cultivation may be little more than one stroke of the heavy harrows before drilling. In preparing wheat land after grass it has been the practice in some districts to employ a "hustler" or stiff-tined cultivator to break down the top few inches before deep ploughing. Several cultivations with narrow tines and later with wider tines worked at an angle across the paddock are required before deep ploughing.

Where wheat ground is to be prepared after crops such as rape, peas, or linseed it is usual to deep plough and follow with one or more discings or grubbings, depending on the nature of the soil. A subsequent harrowing should be sufficient to ensure a suitable seed-bed. On easy working soils a single harrowing may be all that is required after deep ploughing. Similarly, wheat land after potatoes does not require very much cultivation. In the Willowbridge area a ploughing, a grubbing, and a harrowing are the usual operations. In some cases after the potato tops have been removed by chain harrowing the area is given two grubbings and a harrowing before sowing to wheat.

Effect of Variety, Soil Type, and Rotation on Yields

Variety

The New Zealand average yield in 1952 of those varieties commonly grown in Canterbury is shown in Table 5.

TABLE 5—NEW ZEALAND AVERAGE YIELD IN 1952 OF COMMON CANTERBURY WHEAT VARIETIES

Variety	Bushels per acre	Variety	Bushels per acre
Dreadnought	53.0	Hilgendorf	40.8
Hunters	48.0	Fife Tuscan	39.9
Yielder	46.2	Short Straw Tuscan	32.9
Cross 7	42.5		

Though Dreadnought and Hunters are the highest yielding wheat varieties, they are nevertheless grown on the highest yielding wheat soils. Considering that Fife Tuscan is commonly grown on the lower yielding wheat soils, its average yield of almost 40 bushels per acre is comparatively high. Hilgendorf over the past 3 years has yielded reasonably well, being only slightly more than 1⅛ bushels less than Cross 7. Yielder is grown only to a limited extent, but over the past 3 years has consistently outyielded Cross 7.

Soil Types

The 1953 survey previously mentioned provided some estimate of the extent of differences in yielding capacity of the soil groups. The average yield for the soil groups sampled in 1952 and 1953 is shown in Table 6.

TABLE 6—AVERAGE YIELD FOR SOIL GROUPS SAMPLED IN 1952 AND 1953

Soil type	Bushels per acre
Light soils	35
Medium soils of North and Mid-Canterbury	40
Medium soils of South Canterbury	47
Heavy soils of North and Mid-Canterbury	47
Heavy soils of South Canterbury	55

However, one of the heavy soil groups found in North Canterbury near Rangiora and Kaiapoi showed an average yield of only 31 bushels per acre. This was in an area which, although its soil fertility is high, is somewhat unsuitable for wheat because drainage problems limit yields. Here dairy farming is more common than wheat growing.

Crop Rotations

Very little detailed work has been undertaken to demonstrate the effect of rotation on yields of wheat in New Zealand. Some pointers are available from results of two parallel surveys conducted near Christchurch and Ashburton over a period of 5 years. In the Christchurch area, where there is extensive cropping, the yields of the few wheat crops sown after grass were better by 3.5 bushels per acre than the average for the survey. The poorest yields were obtained where wheat was grown after another cereal crop, and these were 4.1 bushels below the average, or 7.6 bushels below the yields for wheat crops after grass. In the Ashburton area, however, where almost 40 per cent. of the wheat crops are grown after grass, the effect of this rotation was to reduce the yield to 2 bushels below average. The best yields here were obtained after peas, whereas in Christchurch the yields after peas were just average or slightly below. In the Ashburton area the yields after another cereal crop were 4 bushels below average, and this agreed with the results in the Christchurch area.

Thus it can be seen that though the previous history does have an important effect on yield, this effect may vary from district to district, or rather it is likely to be related to soil type.

Acknowledgment

The author is indebted to officers of the Soil Bureau at Christchurch and Dunedin who supplied much of the information on the description of the soils, and to the Crop Research Division of the Department of Scientific and Industrial Research, Lincoln, for data on yields and trends.

History of Fruit Growing in Central Otago

THE name Central Otago is generally applied to the drier inland portions of Otago, comprising mainly Maniatoto, Lake, Vincent, and Tuapeka Counties. To many of the early pioneers this region seemed a cheerless and unpromising land, and few would have expected that it would be possible to establish such a flourishing fruit growing industry as that for which the district is now noted. A short account of the history of this industry during the past century, and descriptions of the unique climate, the soils, and the irrigation practices which have made it possible are given in the following article by W. S. Kemp, Horticultural Instructor, Department of Agriculture, Alexandra.

MOST of Central Otago is entirely unsuitable for the production of horticultural crops, and would seem unsuitable for any type of arable farming unless adequate water for irrigation was available.

The areas devoted to horticulture are mainly situated in Vincent and Tuapeka Counties near the Clutha River and its tributaries. They are broken into three main parts by the gorges through which the river flows, namely the Cromwell basin, the Alexandra basin, and the Roxburgh basin.

Today it is difficult to imagine the countryside as it was found by the runholders and miners who first opened it up, but there are still some parts which, though they lack the original tussock cover, are something the same as they were then.

The early pioneers have described this region as a bare, trackless, cheerless land utterly devoid of any trees and covered in a sober cloak of tussock relieved only by grim grey rocks often of fantastic shape, and by bushes of matagouri, or Wild Irishman as it is commonly called. Here range succeeded range in monotonous uniformity and the only sound which greeted the ear was the wailing of the wind among the tussock.

This aspect of the country is in distinct contrast to its present appearance, for though fewer than 100 years have passed since man first settled in the area, a great change has been wrought. The ranges remain unaltered, but most of the tussock, owing to the depredations of man and rabbits, has gone, and has been replaced by the aptly named scabweed. A network of roads makes travel easy, the valleys in many parts are green and pleasant, owing to irrigation, and trees such as poplar, willow, and pine, with farm homesteads and townships, break the old monotony of the landscape.

Climate

The climate of Central Otago is the most striking in New Zealand, and in general terms can be stated to be continental in character, though the distance from the sea is much less than it usually is in places where such a climate is found.

The lofty mountain ranges which completely box in the area cut off to a large extent any influence exerted by the relatively nearby seas.

Rainfall over the whole area is the lowest for any part of New Zealand, ranging from an annual average of about 20in. in the wetter parts to less than 14in. in the drier parts around Alexandra. Much of this rain falls in summer, often in the form of heavy downpours of short duration resulting from thunderstorms, its benefit to the soil being largely nullified by the quick run-off and the high temperatures.

Temperatures also show a wider range than is usual in most parts of the country. Summer day temperatures often range between 80 degrees and 90 degrees F. and winter night temperatures go down as low as 10

HEADING PHOTOGRAPH: Stone fruit orchards in the Coal Creek district, Central Otago. Whites Aviation photograph.

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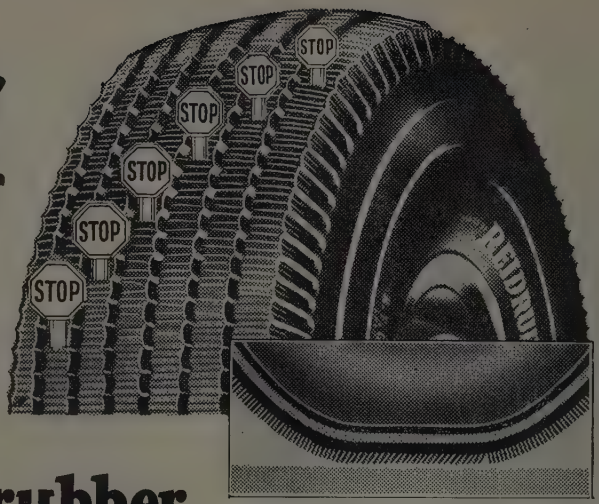

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degrees F. In addition there is often a wide range between day and night temperatures, which may vary by as much as 50 degrees F. Winters are usually severe, frosts being of almost nightly occurrence through the main winter months, with clear skies and sunshine during the day. Hours of sunshine average 2145 annually.

Winds, fortunately, are rare through winter, but at other times of the year are sometimes frequent and severe. The winds are mainly from the south and are frequently the forerunners of out-of-season frosts; occasional hot, drying winds from the north-west are also experienced.

These climatic factors have been largely responsible for the development of the fruit growing industry in those parts of the district where out-of-season frost is less likely. The low rainfall and high summer and low winter temperatures are well suited to the growing of high-class stone fruits, for which the district is justly famous.

Soils

Like the climate, Central Otago's soils are unique. Generally, in terms of geology, they are young soils, being laid down in relatively recent times. They have a sandy texture and consist largely of schist, though one or two other kinds of rock are also incorporated. Generally the rock particles are not greatly decomposed, and as there is a relatively small amount of vegetable matter, the soils are light in colour.

Their fertility is related to the amount of moisture available, and in general they are highly productive where this is adequate. To maintain the best physical condition under irrigation, however, the addition of organic matter to the soil is essential.

These soils, being usually alkaline in reaction, are in direct contrast to the leached, podzolic soils of the higher-rainfall districts. This is due to the low rainfall being insufficient to cause leaching and to a high evaporation rate. This results in the topsoil containing large amounts of soluble matter, which is deposited as the surface water is evaporated.

In general the topsoil is underlain by thick gravel deposits which are, for the most part, free draining.

Early History of Fruit Growing

To the gold miners of the 1860s must go the credit for beginning an era of fruit growing which has come to be the main means of livelihood for the greater portion of the district's population. Few of these people had any previous experience of commercial fruit growing and the countryside in its original state would not have encouraged those with experience to establish orchards in the area. However, it was soon realised that the

The main fruit growing area of Central Otago. The dotted lines indicate railways. The small map at left shows the position of the area and the Clutha River in the South Island.

An orchard area in the Clyde district near the Fraser River. [*V. O. Browne*

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chance of making a fortune from gold was, for most of them, very remote, and those who had grown to like the country and had ultimately lost the urge to follow the lure of gold looked around for some other means of making a living.

Many of them had cultivated gardens around their homes where flowers, vegetables, and small fruits were grown, and found that the surplus from these was easily disposed of. This, and the knowledge held by some of the progress made in similar areas in other parts of the world where irrigation water was available, caused the diversion for agricultural purposes of many of the water races originally constructed for gold mining.

A Frenchman named Feraud is generally credited with being the first to plant out fruit trees. This was in the spring of 1864, when a small number of trees and vines were planted on his farm, "Monte Cristo", near Clyde. Others soon followed suit, notably Dawson and Iversen in Conroy's Gully, Noble at Alexandra, and the Tamblyn brothers, Manuel, Toms, Bennitto, Birch, Moodie, Snell, and Uren at Coal Creek.

The growth of the industry was slow owing to the lack of transport precluding the disposal of produce other than in the immediate neighbourhood. Even then the growers hawked their produce long distances round the diggings, and no public gathering or sports occasion was complete without their offering their wares for sale.

With the dredging boom the population increased and an expansion of fruit tree planting took place, but it was not until the Central Otago railway was completed to Clyde that there was any great increase in orchard areas in Vincent County.

During this period of some 40 years the gold miners, dredge hands, wagoners, and others had in their spare time planted their trees and tended them while engaged in their normal occupations. As in other fruit growing areas in New Zealand land speculation occurred, particularly in Vincent County, where a number of large areas were purchased, subdivided, planted, and sold, mainly to townspeople. Some of these areas proved unsuitable for fruit growing, either because of being subject to damaging frosts or lacking adequate irrigation facilities. Most of them have now gone out of production. The area known as Fruitlands is an outstanding example. Here some 40,000 fruit trees were planted during the boom period 1914 to 1916 and today all that remain are a few trees around the homesteads of the farms to which the district reverted.

Irrigation

Irrigation has always been, and continues to be, one of the main factors affecting the development of the district. Though many millions of gallons flow daily in the Clutha River, the depth of the river below the general level of the surrounding country has made pumping out of the question, except in a few isolated instances. In the beginning water was obtained for irrigation from small private schemes originally constructed for mining. For years endeavours were made to interest successive Governments in the need for construction of major irrigation projects, and in 1911 the Ida Valley scheme was announced; this

Irrigation has always been one of the main factors in the development of Central Otago. Upper—Butchers Dam near Alexandra. Middle—An irrigation race on Earnscleugh Flats distributes water from Fraser Dam. Lower—The Chatto Creek siphon carries irrigation water from one side of the valley to the other.

IMPORTANT FRUIT GROWING CENTRES

Upper left—Clyde. Above—A general view toward Clyde of the Alexandra - Clyde basin, showing the town of Alexandra in the middle foreground. At left—Part of the Coal Creek orchard area near Roxburgh, which is shown at lower left. Below—A view of Cromwell toward Bannockburn. Under dry, sunny conditions and with the use of irrigation much fruit, particularly stone fruit, is grown in all these places.

Photographs by V. O. Browne

was the first of several State-constructed schemes, but it was many years before water from these was available.

Generally, irrigation is carried out by gravity flow through a system of water races linking the various streams and storage dams with the farmer's property. The farmer distributes the water either by the furrow system or by flood irrigation, using borders. In some places water is pumped from a river or other source and then either distributed by gravity or put through a sprinkler system.

A scene at Alexandra railway yards about 1930, showing the type of motor and horse-drawn transport used by growers for carrying fruit.

In general, there has always been a greater demand for water than could be met, and the tendency has been to develop areas in years of higher than average rainfall only to find in the years of short supply that there was insufficient water to meet the demand. There are still many areas suitable for horticultural projects which could be developed if water was made available.

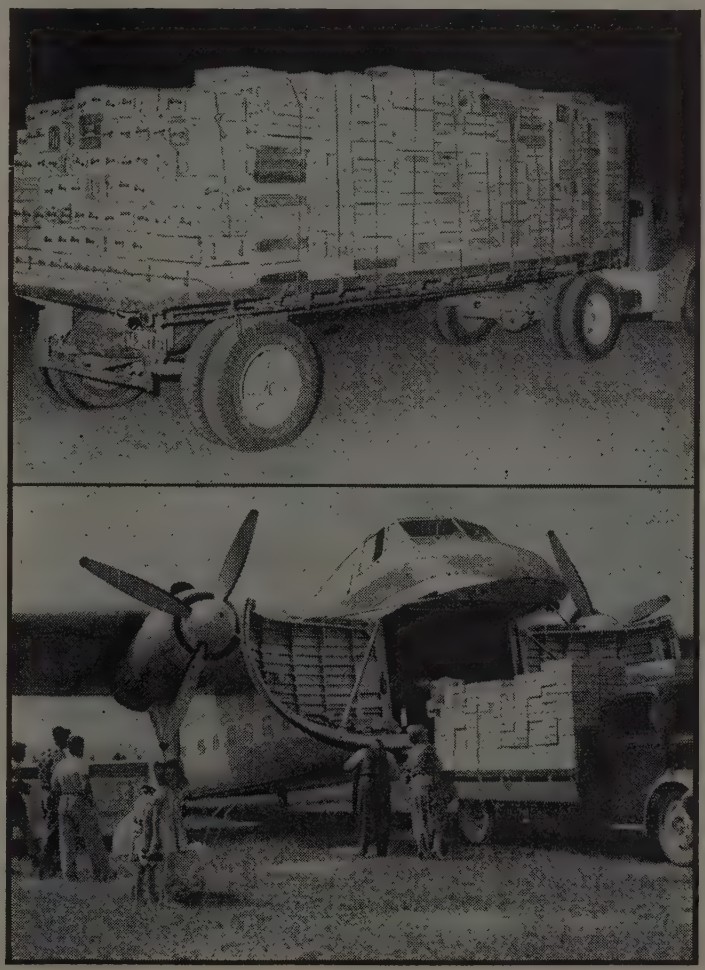
Transport

The area's relative isolation from the main centres of population has always been a factor affecting the fruit growing industry, for with produce of such a perishable nature quick access to the main markets is essential if the grower is to obtain the best results from his labours.

The first transport consisted of spring carts and light wagons used by growers in hawking their produce locally. In 1877 Mr. A. H. Tamblyn was the first to sell fruit on the Dunedin market, when he took a load of 40 cases of peaches to Dunedin by light horse-drawn express and sold them to one of the local shopkeepers. The success of this venture encouraged others to make the long trip, but results were often not encouraging.

By 1877 the railway which was being made from Dunedin to Roxburgh had reached Lawrence, and it was not long before a regular train service enabled fruit to be sent to the Dunedin market after it had first made the long trip (for Alexandra growers of over 70 miles) from orchard to railhead by heavy wagons drawn by up to 10 or 12 horses. This mode of transport between orchard and rail continued until the advent of motor transport, which was first seen in the district in 1915, when motor trucks were used for cartage of fruit.

In these times of easy transport it is interesting to recall the work entailed for growers in the Alexandra area in the early days in getting their fruit to the railway. Before 1895 the fruit was taken to Roxburgh and there transferred to the local carrier. As their crops increased the growers began to haul them to the railhead. To do this they had to leave home at daybreak, so that they could arrive at about 6 p.m. at Miller's Flat, where they spent the night, leaving again at daybreak to arrive at Lawrence before



[*J. F. Shepherd*

Modern methods of transporting fruit. Upper—An articulated lorry with a 10-ton load of stone fruit ready to leave Alexandra for a night trip to Invercargill. Lower—Cherries being loaded into a Bristol freighter at Alexandra aerodrome for transport to the North Island.

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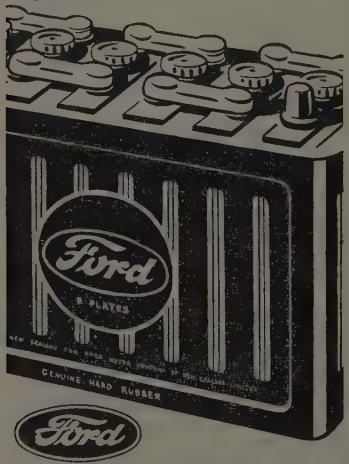

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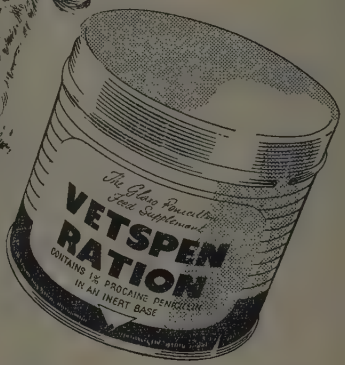

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the departure of the train at 2.30 p.m. Next day the homeward trip began, the first day's travelling taking them to Roxburgh and the following day's travelling to home—4 days after starting out. When the alternate Central Otago line reached Ranfurly this route was adopted, as its shorter distance and easier terrain enabled the growers to start off in the evening after a day's packing, arrive at Blacks about midnight, and, by starting again at daybreak, reach Ranfurly in time to catch the train leaving at 10.30 a.m. Thus the fruit could arrive in Dunedin 2 days after it was picked.

Today most parts of the district are within easy access of the railway or are well served by transport services, and many growers own trucks which they use for carting between orchard and railway. The initial progress of these railways was very slow. The Roxburgh line reached Lawrence in 1877, Beaumont in 1915, Miller's Flat in 1925, and was completed to Roxburgh in 1928. The progress of the Central Otago line was little better, for though construction began in 1879, only 17 miles of track had been laid in 10 years and Ranfurly was not reached until 1900. Progress was then relatively rapid, Alexandra being reached in 1906 and Clyde the following year, but it was 1922 before traffic began to run from Cromwell.

Special night trains are now run during the main part of the fruit season, so that fruit picked during the day can be sold in Dunedin the next morning and in Canterbury centres the following morning. A night lorry service enables fruit to be sold at Invercargill the next morning.

A factor affecting present distribution of fruits such as cherries and apricots which are normally marketed in the North Island as well as in the South Island is the restriction on the daily amount carried on the inter-island express steamer between Lyttelton and Wellington. To overcome this, use is being made of the air service, particularly in the distribution of cherries. There has been a growing use of air transport in recent years: Two years ago the Railways Department inaugurated a direct flight between Alexandra and Wellington during Christmas 1952, which was so well supported that the service was increased in the 1953 season. Considerable quantities have also been lifted from Taieri Airport, Dunedin. The expansion of this type of transport will depend largely on whether the return to the grower is sufficient to cover the extra cost of freight charges.

Plantings

Today Central Otago orchards comprise a mixture of pip and stone fruits, with some areas, such as Coal Creek, growing predominantly stone fruit, and others, such as Ettrick, growing predominantly pip fruit. Originally stone fruits formed the bulk of the trees planted, especially after the introduction of codling moth and other diseases had caused growers to replace many of their apple trees with stone fruits. Plantings during the 1910-15 boom period were mainly apple, because of the possible export market. Since then the trend has been for a general reduction in the apple tree figures, with an increase in stone fruit plantings, especially in Vincent County, since 1945.

This stone house near Alexandra is similar to the dwellings erected by the early settlers in the area.

Before 1880 there were 13 orchards, totalling about 22 acres, at Coal Creek and half that number in the Alexandra area. In 1894, when Mr. J. C. Blackmore, who had been appointed in 1893 by the Government as pomologist to assist the fruit growing industry, visited the district he estimated there were about 70 acres planted in Coal Creek and 49 acres in the Alexandra district.

Planting of orchards increased slowly until 1909, but from then until 1915 there was a rapid increase, the total area more than trebling in that period. During this period a number of the large Australian nurseries had local representatives to push the sale of their trees, which could be obtained landed in New Zealand for less than £3 per hundred. Since 1926 the area has decreased considerably, especially in Vincent County, though since 1945 there have again been considerable plantings, the bulk of which have comprised stone fruits. At present there are 240 orchards, totalling 1586 acres, in Vincent County, and 112 orchards, totalling 1421 acres, in Tuapeka.

Individual holdings vary considerably in size, the average for the district being about 8 acres. However, a considerable number of these are managed in conjunction with other types of farming and so do not give a true indication of a unit from which a living can be made. In general an economic area of 6 to 8 acres of stone fruit would return a good living. Double that amount would probably be required for pip fruit.

Production

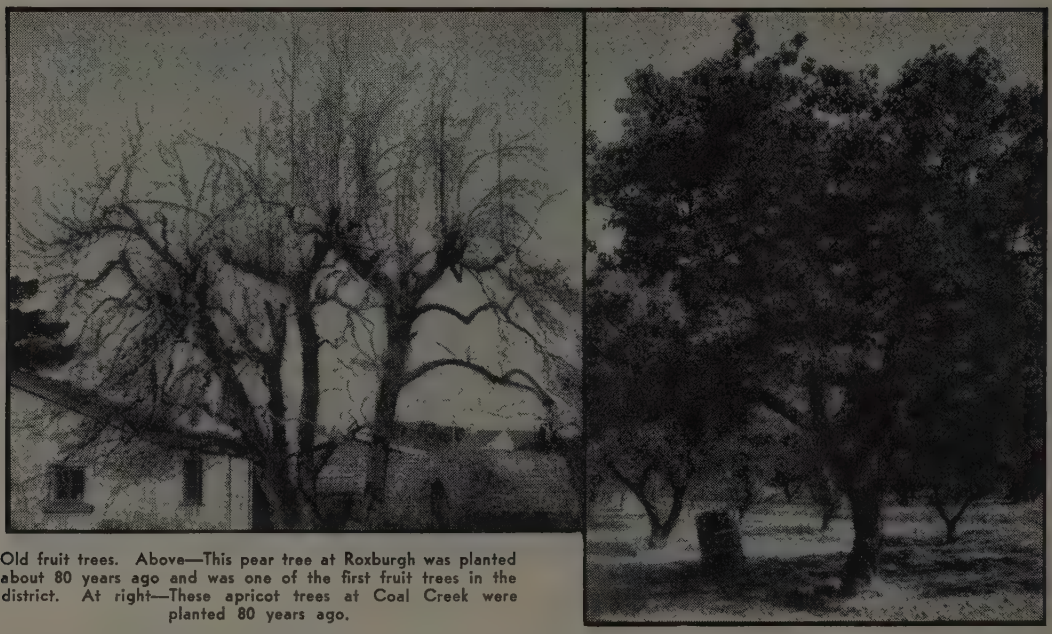
Few early records of production figures are available. In 1892 the quantity of fruit handled in Dunedin by the growers' co-operative marketing scheme was over 116 tons, and 2 years later it had risen to 197 tons. Before the Department of Agriculture made estimates of fruit crops annually, the only figures available were of railway tonnage, which date back to 1920. These, based as they are on a year ending 31 March, do not give a true picture of the annual fluctuation, as the bulk of the pip fruit crop was included in the following season's figures, thus tending to even out the good and the bad years. Today these seasonal fluctuations occur much less than in the past owing to better cultural practices, frost prone areas going out of production, and the increased use of oil in combating late spring frosts.

Despite the reduction in area, production, particularly in Vincent County, has risen steadily over the years on the basis of railway tonnages.

General Cultural Practices

Many of the early plantings, originating as they did from small areas planted for the owners' personal use and with hand methods of cultivation, have left close-planted blocks which are awkward to work. Today most planting is done on the square system, 18ft. between trees being almost universal. Cherries, particularly where netted, are usually planted closer, and apricots can with advantage be planted farther apart.

The growing of shelter belts has not been generally adopted, and where necessary they consist mainly of a single row of trees around the perimeter of the orchard. The two types of trees generally used are Lombardy poplar and *Pinus radiata*. Lack of adequate water for irrigation has probably been one of the main reasons why more shelter was not used. Poplar is relatively easily established, but compared with pine it is



Old fruit trees. Above—This pear tree at Roxburgh was planted about 80 years ago and was one of the first fruit trees in the district. At right—These apricot trees at Coal Creek were planted 80 years ago.

a great soil and moisture robber. More shelter could be used with good effect in many places, provided care was taken to ensure that the natural air drainage was not upset, with consequent increase in frost risk.

Early pruning practices can best be described as haphazard, if not non-existent. The first secateurs were introduced about 1895; before that the pruning knife was used. Today pruning is an established practice with all fruits. The style adopted differs between growers and districts, and is more severe than in other parts of the country. Much more wood is removed, especially from stone fruits, owing to the better development of fruit buds at the base of the new growth as compared with that on trees in other parts of New Zealand.

Cultivation practices have changed considerably from the early days, when orchards were all hand dug and always up-hill. Now very few growers, particularly in the drier areas, do clean cultivation throughout summer. The trend today is to cultivate as little as possible, what cultivation there is being done mainly in spring and autumn. Other growers are adopting a system whereby the orchard is either sown down annually with a grass seed mixture or natural reseeding is permitted, this cover being mown periodically and then turned under in autumn. Mulching with pea and ryegrass straw brought in from surrounding farming areas is also largely practised, particularly in Vincent County. Provided adequate supplies of fertilisers are incorporated to counteract the nitrogen deficiency likely while this material is breaking down, this method does much to incorporate the organic material which is lacking in the natural soils and which is quickly lost with cultivation during high temperatures.

Owing to the natural fertility of most of the soils of the district it is not general to apply heavy dressings of fertiliser. In the past blood and bone has been the main manure used and the usual rate of application has been about 3cwt. per acre. Today the trend is to use a balanced mixture of inorganic fertilisers because of the difficulty of obtaining suitable quantities of organic material. Nitrogen is the one major element most likely to be in short supply, and this is the element from which the greatest response should be obtained, particularly in stone fruit orchards and in the older plantings. Owing to the general high alkalinity of the soils, liming is not usually necessary and indeed if it was applied too liberally, could cause trouble with deficiencies of minor elements such as zinc, manganese, and iron. The lack of boron in the soil has been known for a good many years and it is a general practice to apply this element either as a soil dressing from time to time or to incorporate it annually in one of the sprays. Recently manganese and zinc have been shown to be lacking in some soils in certain localities and there is a distinct possibility that in future greater use will be made of these elements.

Fruit Preserving

The fruit preserving branch of the industry, which could play a much more important part in the general economy of the district, has suffered in the past from various disabilities, chief among which have been transport difficulties and lack of regular support from growers.

Utilisation of fruit other than fresh fruit has been advocated at various times, particularly in years of heavy crops, but it was not until 1904 that a move was made by the Teviot and Alexandra Fruitgrowers' Association. As there was insufficient time to obtain equipment before the season started, arrangements were made with a Dunedin firm to put up a line of fruit pulp for them so that a start could be made and a name established. The services of a canning expert appointed by the Government were used and a factory was opened at Roxburgh. After a few years it was found that inward and outward freight rates made it impossible to continue, and the venture was discontinued and the equipment sold to a Dunedin firm.

Two factories had been operating in Dunedin for many years processing fruit, but transport difficulties had made it impossible to use this outlet to any great extent. Even when the railways were completed the lack of regular support from the growers made it impossible for the factories to expand their output.

At Roxburgh East in 1940 a fruit drying plant was established which operated on a fairly large scale during the war. This has now closed down and at Coal Creek a factory has been established which is making jams and fruit pulp.

Though the quickfreeze process has not yet been undertaken commercially locally, it is another avenue of disposal which in future should play an important part in this branch of the industry.

Cool Storage

The first cool store in which fruit was held fresh for later sale was

erected at Alexandra in 1919, but as the store had been designed principally for the rabbit trade and was not entirely suitable for fruit storage, it was not very successful. This store has since been redesigned and can now hold up to 20,000 bushels of fruit.

In recent years a considerable number of small stores have been erected on growers' own properties and today there are probably a greater number of individual stores in Central Otago than in any other fruit growing area in the country. These are largely used for the pre-cooling of stone fruit so that it may arrive in firm condition after travelling to distant markets, or for holding the fruit over short periods such as weekends or holidays. Where pip fruit is grown in sufficient quantity to fill cool stores these stores are also used for long-term storage, particularly of apples.

These stores have been of considerable value to the growers in that they have enabled the crop to be handled with a smaller staff.

Pest and Disease Control

The first serious outbreak of disease occurred during the 1880s, when codling moth, black spot, scales, and various other insect pests seriously affected the fruit. Their introduction was blamed largely on the use of second-hand fruit cases, and this is still a contributing factor. The first attempt at therapeutant treatment is attributed to Mr. R. Bennetts, of Coal Creek, who painted his trees by hand with whale oil. Growers at this stage had no knowledge of disease control and no advisory service to guide them. Many different mixtures were tried, some of which caused serious damage and even death of the trees. In 1893 Mr. J. C. Blackmore was appointed pomologist to the Department of Agriculture, his duties including instruction to fruit growers in the South Island. He was responsible for the introduction of spray materials and sprayers, and by demonstrating their efficiency encouraged growers to use them. One of the articles of the Teviot and Alexandra Fruitgrowers' Association was that each member should bind himself to act by the majority decision in cleaning up any diseases in his orchard.

Early pumps, either of the knapsack type or fitted to a cask attached to a sledge or dray, were all hand operated, and it was not until 1910 that the first power-driven sprayer was demonstrated. Today, though some orchardists

rely on contract spraying, many have their own pumps, usually of the portable or semi-portable type. Pumps of 10 to 12 gallons per minute capacity are the most popular and appear adequate, especially in predominantly stone fruit orchards, where usually a small number of sprays will give control of most diseases and pests.

Many of the fungus diseases common to fruit growing areas in other districts are present, but their attack is usually much less severe and their control easier owing to the dry climate not favouring their development. Powdery mildew (*Podosphaera leucotricha* (Ell. and Ev.) Salmon) on susceptible apple varieties is the most common, and brown rot (*Sclerotinia fructicola* (Wint.) Rehm.) can cause considerable loss in some parts in years where weather conditions are favourable. Others commonly occurring are black spot of apple (*Venturia inaequalis* (Cke.) Aderh.), pear scab (*Venturia pirina* Aderh.), leaf curl (*Taphrina deformans* (Berk.) Tul.), shot hole (*Phyllosticta prunicola* Sacc.), and silver leaf (*Stereum purpureum* Pers.).

Fireblight (*Erwinia amylovora* (Burr) Winslow), a bacterial disease

Below—Spraying apple trees in a Roxburgh orchard. J. F. Shepherd photo.

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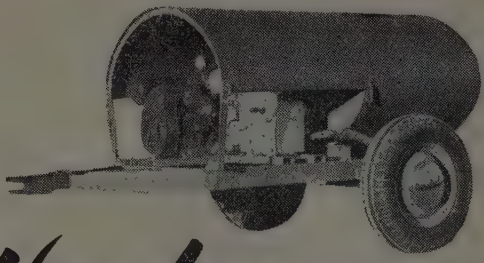

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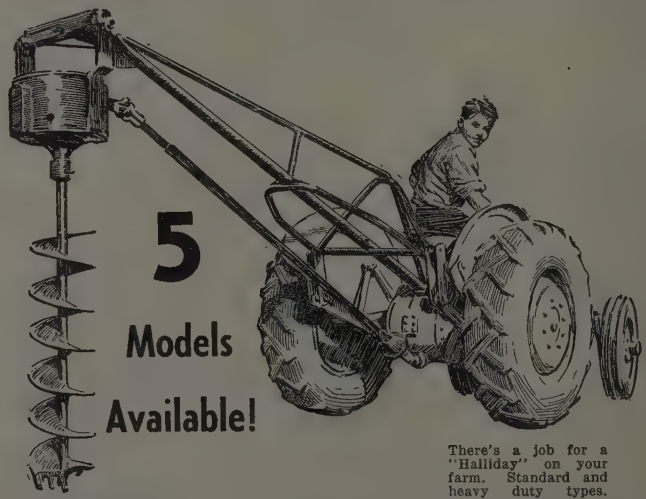

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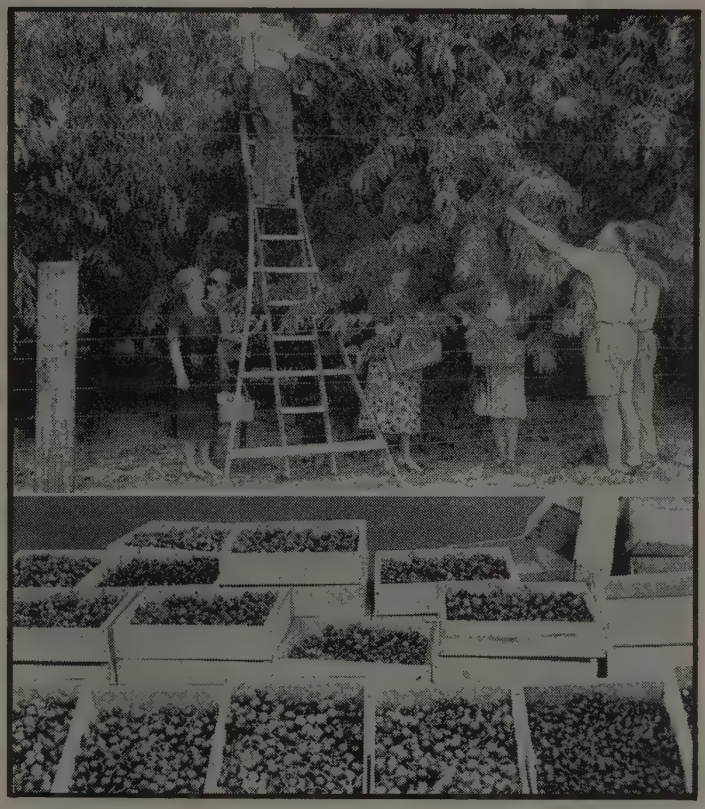
affecting pip fruits, was first discovered in the district in 1939. Since then it has been the cause of considerable losses, particularly in pears in a number of seasons when it has become epidemic. Deaths of 3- and 4-year-old trees, which had been causing serious losses in young blocks for a number of years, have lately been shown to be due to stone fruit blast, which is also of bacterial origin.

Insect pests are usually much more troublesome, though these also are fewer than are to be found in other areas. A more rigorous spray programme is needed to keep them under control. The main ones attacking fruit trees are codling moth (*Cydia pomonella* L.), leaf-roller caterpillar (*Tortrix* spp.), European red mite (*Paratetranychus pilosus* C. and F.), red mite or clover mite (*Bryobia praetiosa* Koch), woolly aphis (*Eriosoma lanigerum* Hausm.), green peach aphis (*Myzus persicae* Sulz.), black cherry aphis (*Myzus cerasi* F.), pear slug (*Caliroa limacina* Retz.), San Jose scale (*Quadraspidiotus perniciosus* Comst.), and various other scales. These can, however, be kept under control by regular sprays thoroughly applied at the correct time.

Rabbits and hares are also a problem, especially in young orchards, but can be kept out by wire-netting fences. The efforts of the Rabbit Boards are considerably reducing this pest. Birds are the cause of considerable losses in some seasons, not only of fruit but also through destruction of buds during late autumn and winter. Feeding poisoned grain and bounties on eggs are two of the methods adopted over the years to endeavour to keep them in check. In cherry orchards, shooting, carbide birds scarers, and travelling scarecrows are widely used, and a considerable area is netted. The small bird nuisance has been with the industry since its inception; fortunately depredations of birds are seldom widespread, though in some years considerable damage has resulted.



[*J. F. Shepherd*

Upper—Harvesting cherries at Alexandra. Lower—Cherries ready to be transported to a packing shed.

Fire pots set out ready in an orchard to prevent frost damage.

Spring Frosts

A further problem affecting the development of the industry has been the risk of late spring frosts. There are a number of areas which can be described as free from damaging frosts, particularly the Cromwell Gorge and some of the more elevated hillside orchards where natural air movement is sufficient to prevent late spring frosts. With the growth of the industry and the difficulty of getting irrigation water to these frost-free areas, growers in recent years have had to be content with other land subject to out-of-season frosts.

After a series of frosts in the spring of 1926 which wiped out the bulk of the fruit crop, growers approached the Government; as a result all available information on orchard frost prevention was collected and experiments were begun in 1927 with the type of open pot, still in use today, known as the lard pail and burning fuel oil. After these experiments a number of growers installed sufficient fire pots to protect parts of their orchards. A series of frosts in the spring of 1933 which proved to be the most disastrous since fruit growing began caused more growers to install equipment, as those who had already done so were the only ones in their locality with any fruit to harvest.

In 1937 Mr. Lloyd-Williams, then Orchard Instructor, Department of Agriculture, Alexandra, at the request of the fruit growers was sent to America to study latest developments in frost protection, but nothing was found to supersede the methods then in use. During latter years there has been a considerable increase in the number of pots installed, which has resulted in a further problem. The smoke cloud arising from the burning pots has, under still air conditions, remained to obscure the sun and so prevent the natural warming of the atmosphere. As a result growers have raised a sum of money to be given as a prize to anyone who can produce an economical system of frost fighting which will do away with the smoke nuisance.

Handling the Crop

Harvesting of the fruit is done by the grower with the aid of whatever casual labour is available to augment his permanent staff. With the bulk of stone fruit harvesting falling during the long school summer holidays and with the need for increased staff on orchards over a short period to handle the crop, a large number of high school

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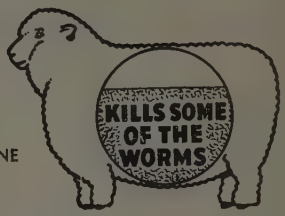

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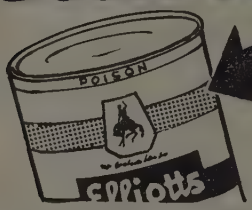

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and university students are employed. The marketing of stone fruit is the growers' responsibility and each packs his fruit to his own standards. These, for the most part, are satisfactory and in some cases high, but in others there is room for improvement if the best results are to be obtained from the market. Apples and pears, however, apart from those sold in small lots direct to consumers, are sold through the New Zealand Apple and Pear Marketing Board, which adopts the standards for grading and packing laid down by the Department of Agriculture.

Co-operative packing establishments have been tried in the past, but have not met with any success in Central Otago. One type of fruit-sizing machine is adopted almost generally throughout the district as being the most suitable for handling stone fruit.

The bulk of the fruit is disposed of in the South Island, but a considerable portion of certain kinds, such as cherries and apricots, is marketed throughout the North Island as well.

In the early stages of the development of the industry the container generally used for picking into was a small bucket and this is still used to some extent. Generally for pip fruit a canvas picking bag or apron is now used; for stone fruit the article most generally used is a half case or tray, depending on the type and condition of the fruit to be picked. This container is carried round the neck by a broad leather strap with screw clamps at each end.

Illustrations at right and below—Handling of fruit. Upper right—Drying apricots at an old factory at Alexandra. Middle right—Packing apricots for market. Below—A modern packing shed, showing the type of sizing machine most commonly used in Central Otago. Photograph at middle right by National Publicity Studios; photograph below by J. F. Shepherd.

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A fruit processing factory at Coal Creek.

The original container used for carrying fruit to market was the second-hand Australian orange case measuring 14in. x 6in. x 28in. with a division in the centre. These cases were made of hand-split stringy bark and weighed 17lb., which was a load in itself. It was not long before the demand for cases caused local mills to cut them out of various local timbers. Today there are two mills in the Tapanui district cutting cases out of *Pinus* species. The original sized case was used for many years, but was later changed to a smaller case more easily handled. Today there are several types in use ranging from the bushel case for pip fruit down to the half-bushel cases, trays, and cherry cases for stone fruit.

In the early days the time taken for the fruit to reach the consumer made it necessary to pick the fruit in a hard, green condition to ensure that it was not over-ripe on arrival. Today, however, with rapid transport and orchard cool storage facilities for pre-cooling, it is possible to pick the fruit in a more mature condition and so ensure that the consumer gets a superior class of fruit.

Associations and Co-operatives

The first banding together of growers for their mutual benefit was in 1894, when the Teviot and Alexandra Fruitgrowers' Company, the first of its kind in New Zealand, was formed. It was designed primarily to keep orchards free from disease, to have fruit packed to standards, and to market the fruit to the best advantage of the growers through a central agency in Dunedin. This body continued to operate until 1899, when it went into voluntary liquidation.

It was not long before the desire to have some organisation which might speak for growers as a whole resulted in the formation in 1901 of the Teviot Fruitgrowers' Association, which is still in existence. As the industry grew, further associations were formed in other parts of the district, and at present there are five such bodies. In the past they provided a meeting place where problems of the day could be discussed and from which approaches could be made to the Government and other organisations. Later they assumed the function of trading concerns, dealing on behalf of their members with various suppliers of orchard requisites and arranging finance so that growers could obtain their supplies at the lowest possible cost. Today these trading rights have been relinquished to the New Zealand Fruitgrowers' Federation, a Dominion-wide organisation of fruit growers which has established trading branches in Roxburgh and Alexandra as well as in other parts of the Dominion. The district associations still deal with local problems and may forward remits for discussion at the annual conference of the New Zealand Fruitgrowers' Federation.

A further effort at co-operative marketing was the formation of the Co-operative Fruitgrowers of Otago Association in 1916. Eventually a permanent auction mart was opened at Dunedin in 1924 and continued with varying success until 1939, when lack of support and high overhead costs caused it to go into liquidation.

Experimental Station

As early as 1897 growers had asked for an experimental station where problems affecting fruit growing in the district could be studied. The lack of adequate irrigation water, among other factors, caused the project, which had received the support of the Government of the day, to be dropped. Representations continued to be made from time to time, but it was not until 1946 that these had any result. In that year Plant Diseases Division of the Department of Scientific and Industrial Research purchased a property at Earnscleugh which is being built up into a unit where the various problems affecting the industry can be studied.

So far the main emphasis has been on establishment and research into frost problems, but the station should provide the means of solving many of the problems now affecting the industry and will provide a place where long-term trials and experiments can be carried out to their conclusion.

Future of the Industry

The development of the industry in Central Otago has not been without its difficulties and no doubt some of these will be present in the future. Great credit is due to those who pioneered the industry and survived its ups and downs. For many years growers made little more than a bare existence, the good years being offset by the frost years. The boom period before 1920, with many orchards being planted in unsuitable areas, did little to help the stability of the industry. Lack of finance, inadequate irrigation, frost, and inexperience all took their toll.

Today, however, with better cultural practices, increased frost protection, less incidence of damaging frosts, and better returns for fruit, there are much brighter prospects for the industry, though the difficulty of obtaining from a perishable product returns sufficiently high to offset the ever-rising costs of production is exercising the minds of growers.

The brighter outlook of the early 1940s had the effect of encouraging fresh plantings, some of these by returned servicemen on new areas. This should help to take the place of the older areas which are slowly going out of production, to ensure increased supplies in the years ahead, and to meet the demand likely to arise from an increasing population. Further areas suitable for fruit growing are available, but in the majority of cases they lack an efficient water supply.

Though the bulk of the increased plantings has been in apricots, in the growing of which Central Otago excels all other fruit growing districts, the ravages of stone fruit blast have greatly reduced the effective plantings, and the difficulty of obtaining trees is now precluding any further expansion on a large scale.

As other kinds of fruits can be grown successfully in other districts, care is essential to ensure that production is kept within the bounds of possible demand, though an outlet which has distinct possibilities for expansion, given regular supplies, is the production of canned and quick-frozen products.

Acknowledgment

Acknowledgment is made of the assistance of the late Mr. W. S. Craig, Coal Creek, Mr. Alec Taylor, Alexandra, and others in providing information regarding the early history of the industry.

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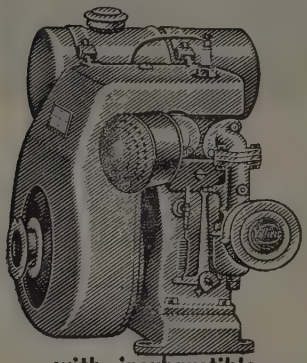

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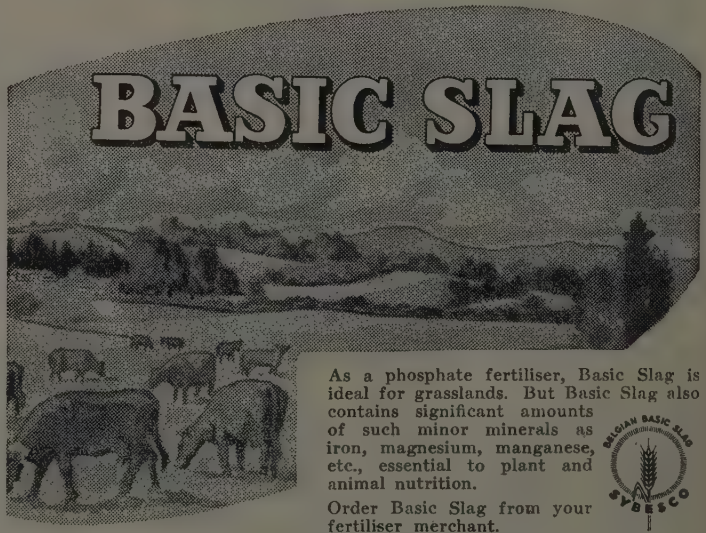

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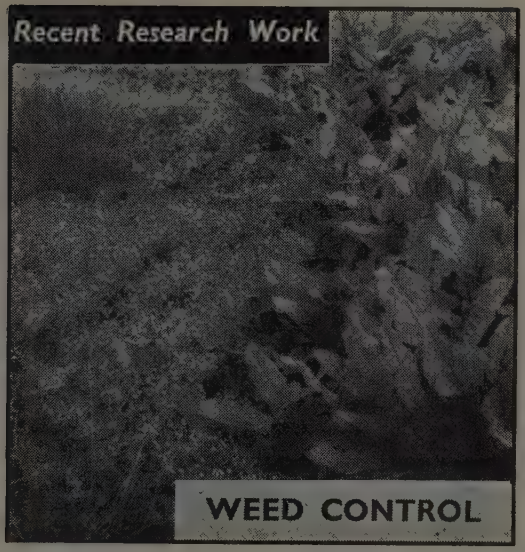

METHODS for the control of troublesome weeds are continually being improved and these notes record some recent work carried out by Extension Division officers of the Department of Agriculture on the suppression of docks and floating sweetgrass.

DOCKS

DOCKS are often prevalent under conditions of high soil fertility, and under the lax grazing of high producing pastures are frequently a serious problem. Recent research work has shown that weedkillers are now available that will substantially reduce dock infestations. Of the hormone weedkillers, the preparation that has given the most satisfactory control has been the polyethylene glycol ester of 2,4-D (P.E.G. 2,4-D) marketed under various proprietary names. In general the amine salt preparations of 2,4-D have been less satisfactory. In trials on established docks conducted at Te Awamutu, Blenheim, and the Department of Agriculture's Invermay Agricultural Research Station the time of application was shown to be critical. The best results were obtained with these hormone preparations if they were applied when the docks were flowering and in the stage of seed head formation. Applications before or after this stage have proved disappointing.

CLOVER DAMAGE

Unfortunately at this stage of growth docks have already suppressed the pasture growth around them, but trials have shown that once the foliage of docks has been killed the pasture fills in quite readily. Clover damage or suppression usually occurs because a high rate per acre of acid equivalent is required, not less than 2lb. per acre being necessary on established docks. Clover damage, however, can be reduced by hard grazing immediately before application. The purpose of this is twofold: To reduce the clover leaf absorption area and to expose the docks' leaves to the weedkiller spray.

DOCKS IN COWGRASS

Trials have also been carried out to control docks in cowgrass, a crop that is highly susceptible to preparations of 2,4-D. In these trials spectacular dock control has been obtained with the diethanolamine salt of maleic hydrazide (MH_{30}). Applications of this chemical were made at 1lb. per acre on spring regrowth docks and regrowth docks after harvesting. In these trials maleic hydrazide was up to 60 per cent. more toxic to the docks (largely *Rumex obtusifolius*) than the polyethylene glycol ester of 2,4-D or amine salts of 2,4-D applied at 1lb. and 2lb. acid equivalent per acre. (the docks were at the wrong growth stage for best results with the hormone preparations). No cowgrass was damaged by the action of maleic hydrazide. The cowgrass seeded normally. This work has been extended to pastures, but no results are available. The work with maleic hydrazide is still in the initial stages and further work is required. This material must be applied to soft growth and several days of fine weather should follow the application for optimum results. The material will probably not be of value for mature, woody docks.

DOCKS IN NEW PASTURES

Docks are often a problem in newly established pastures. Successful treatment of seedling docks has been obtained with rates of up to 1lb. per acre of the amine salt of 2,4-D applied when the clover has passed the 4 to 5 true leaf stage. Clover suppression is often associated with application of 2,4-D at this stage of growth in the pasture. Further work with maleic hydrazide is required to ascertain its value in dock control in young pastures.

—J. N. FITZGERALD, R. B. GORDON, and W. F. LEONARD

* * * *

FLOATING SWEETGRASS

FLOATING sweetgrass (*Glyceria fluitans*) is a common weed in waterlogged areas throughout New Zealand. Though it is palatable to stock, it is troublesome where its vigorous growth blocks drains and ditch outlets. This often necessitates expensive cleaning every year. Chemical control of floating sweetgrass was undertaken in a trial at Invermay Research Station on a waterlogged area beside a main ditch. The treatments included use of T.C.A., Endothal, and C.M.U., which have shown promise with grassy type weeds. The plots were sprayed in November 1953 when the top growth was 4in. to 6in. high. With the subsequent dry season the area remained dry for 4 months and then was flooded. The dry period may have had the effect of keeping the weedkillers in the soil longer than could be expected in a wetter season.

T.C.A.

Applications of T.C.A. were made at 40lb. and 80lb. per acre. Good control was obtained from both rates, but the high rate had a more rapid and permanent effect. After 8 months a small amount of regrowth was observed in the 40lb. per acre treatment and the roots of some plants were found to be healthy. This was not apparent in the 80lb. per acre plots, where the plants were all killed. Both treated areas showed bare ground 6 weeks after the application.

ENDOTHAL

Applications of Endothal were made at 10lb. and 20lb. per acre. Endothal showed a severe initial effect by burning off the top foliage, but this was short lived and after 6 weeks no difference could be seen between the plots treated with Endothal and the control plots. Endothal acts primarily as a defoliant and rates in excess of those given here may be necessary for control.

C.M.U.

Applications of C.M.U. were made at 30lb. and 60lb. per acre. Both treatments gave excellent control, though the main effect was not seen until 4 weeks after the application. All top foliage was burnt off and the roots killed, the plots becoming completely bare. Inspection revealed no regrowth of the floating sweetgrass and there was no evidence of any after 8 months. C.M.U. appears to be the best treatment and at 30lb. per acre adequate control was obtained.

METHODS OF CONTROL

The results described show that floating sweetgrass can be readily controlled by chemical weedkillers. The spraying of ditches and drain sides would certainly check the spread of its growth. However, with periodic flooding the effect of the weedkillers may be considerably reduced, as they would be quickly leached from the soil. By applying the weedkiller in late spring or summer there would be less risk of this and the effect should last into autumn. T.C.A. acts primarily as a root killer and it would be most susceptible to leaching. Observations on the plots showed that other weeds tend to replace the floating sweetgrass. If regular spraying were carried out, measures would have to be included to prevent the spread of other weed species.

—J. N. FITZGERALD

HEADING PHOTOGRAPH: Control of docks in cowgrass. Left—Plot treated with MH_{30}. Right—Control plot.

Control of Water Hyacinth in Rotorua District

By C. R. TAYLOR, Fields Instructor, Department of Agriculture, Rotorua

IN the April 1949 issue of the "Journal" E. R. Marryatt, formerly the Department of Agriculture's Fields Instructor in the Whakatane district, drew attention to the presence of a serious aquatic weed, water hyacinth, in certain Rangitaiki canals. As an introduction to a very interesting and informative article on the plant he said: "Although water hyacinth may be considered a plant of extreme beauty, its evil reputation overseas is evident in other names for it such as 'Florida devil' and 'the world's worst weed' and in America it is called 'the million dollar weed'. The names indicate the concern it causes and the cost of controlling it, and should indicate the wisdom of preventing it from becoming permanently established in New Zealand."

AFTER the discovery of water hyacinth in Whakatane County a reconnaissance survey of the Auckland Province was undertaken in the winter of 1950 by officers of the Departments of Scientific and Industrial Research and Agriculture to determine the incidence of water hyacinth infestation and to record incidental data concerning dispersal and control.

At Rotorua water hyacinth was found in some quantity in a lagoon on Lake Rotorua adjacent to Ohinemutu (Figs. 1 and 3) and other places. That portion of the report by A. J. Healy and D. I. Glue dealing with this discovery reads:—

"Evidence as to the origin of this infestation is not reliable, although it is stated that a Maori employee of the Rotorua Borough Council placed plants in the bay at Ohinemutu about 10 years ago.

"The locus of the Lake Rotorua infestation appears to be in the bay immediately west of the Ohinemutu church while the remainder of the plants observed at other parts of the lake have been dispersed from this locus by wind and wave action.

"It appears likely that the pattern of distribution of the infestation and probably the successful establishment of the weed in this locality (altitude 915ft. above sea-level) is closely related to the temperature of the water in the lake at Ohinemutu. In this particular bay where the main stationary mats of the weed are growing, a number of hot springs discharge through the lake bed, causing the water to be warmer than at other parts of the lake.

"Mr. Saxby, Agrostologist, found that the plant was thriving at temperatures up to 90 degrees F. [Fig. 1] and in one instance normal plants were found at 110 degrees F.,

HEADING PHOTOGRAPH (Fig. 1): Dense mats of vigorous water hyacinth growing in very warm water in the lagoon at Ohinemutu. The steam at the back is rising from thermal water. Hyacinth in the foreground is flourishing in water of 82 degrees F. and that in the background is growing quite vigorously in water up to 90 degrees F.

although there is a possibility of a mat having been water-borne by wind and wave action to the temperature recording site just prior to observations being taken; dead plants were noted in water at 130 degrees F. These temperatures are possibly low for the bay, in that recordings were taken during a north-east wind, which would tend to move cold lake water into the bay.

"Plants of all sizes were noted in this infestation but by far the largest plants seen on the survey were present here: The leaf dimensions of the largest leaf measured were:—

	in.
Overall length	30.75
Length of blade (lamina) ..	6.25
Breadth of blade (lamina)	4.5
Length of petiole	23.5

"Examination showed water hyacinth plants, either as odd plants or mats, round the shores of Lake Rotorua to north of Ngongotaha and past the Queen Elizabeth Hospital near the lake shore on the east. On the east of Ohinemutu mats of the weed were present along the shore as far as Kawaha Point and thereafter odd plants: These all have the appearance of having been deposited there by wind and wave action, rather than being established there. It is probable that these plants dispersed to points east and west of Ohinemutu do not survive the winter period, but only continued observation can settle this point. Alternatively it could be that the plant has only reached these areas in recent times and more permanent widespread type of infestation is coming into being.

"Odd plants were noted in backwaters on the south-east side of the Ohau Channel, joining Lakes Rotorua and Rotoiti, but no evidence was noted of the weed in Lake Rotoiti. Since the water from Lake Rotoiti passes down the Kaituna River to the Bay of Plenty it was deemed necessary to examine the lower reaches of this river, but observations of the Kaituna River between the Whakatane-Tauranga state highway and the outlet at Maketu showed no trace of the weed."

As water hyacinth was found at so many widely separated points round the shores of Lake Rotorua and the Ohau Channel some misgivings were entertained lest the weed had succeeded in entering the Kaituna River, which has its source in Lake Rotoiti and thus was endangering, or liable to endanger, the fertile drained swamp areas along its lower reaches at Te Puke and Maketu. Fortunately, however, an examination of this locality showed no trace of water hyacinth.

Infested Areas

More detailed surveys of Lakes Rotorua and Rotoiti made later revealed that water hyacinth was much more widespread than the original reconnaissance survey indicated. Large masses of additional infestation were found in Lake Rotorua adjacent to Hinemoa Point and in the vicinity of the Te Ngae Mission Church, and smaller but no less potentially dangerous patches were discovered at Hamurana, Kawaha Point, and behind the Catholic Presbytery at Ohinemutu. Lake Rotoiti, hitherto thought to be free of the weed, was found to harbour several relatively large infestations in Te Akau Bay (Fig. 4), a pretty and well-sheltered inlet only a few chains away from the entrance to the Kaituna River. The Ohau Channel was also discovered to be providing a home for the weed in far bigger quantities than was originally supposed. There was no evidence, however, of the weed permanently infesting the shores of Mokoia Island.

Fig. 2—The clearance that followed two draggings from the Ohinemutu lagoon (compare with Fig. 1). However, despite what appears a good clearance there were sufficient small plants left to restart the infestation. A year after this photograph was taken fairly extensive spraying was necessary to dispose of the weed finally.

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Observations demonstrated beyond much doubt that in the comparatively deep, clean, cold water of the lakes and streams of the Rotorua district water hyacinth shows no evidence of establishing and thus becoming a nuisance. However, it was only too apparent that in shallow, muddy water and slime where raupo and rushes thrive (Fig. 5) hyacinth will often flourish profusely regardless of water temperature. Admittedly such masses of plants never appear to attain the same vigorous growth characteristics of those more fortunately placed in or near water of higher temperature, but their very existence causes constant anxiety lest they break away from their anchorage during stormy weather and re-establish elsewhere.

With the possible exception of the Ohinemutu infestation, which is mainly associated with open, clear water of high temperature resulting from thermal activity, all others are characterised by an association of shallow cold water, mud, raupo, and rushes. In these latter circumstances the weed is invariably difficult to find and still more difficult to treat when found (Fig. 6). Usually such areas are impossible to approach satisfactorily in a boat and only just less troublesome from the land side. For these reasons work of eradicating the weed has often proved not only unbelievably arduous and unpleasant, but extremely costly.

Control Measures

First attempts to rid the waters of Lake Rotorua and the Ohau Channel of water hyacinth then known to exist (1950) took the form of dragging the weed from the water with hand drags, piling it into a boat powered by an outboard motor, and when the boat was fully loaded putting the load ashore at some convenient spot where it could be picked up by motor lorry for conveyance to the borough council dump for destroying.

Fig. 4—One of several infestations of water hyacinth found in Te Akau Bay, Lake Rotoiti. The photograph was taken 2 weeks after the hyacinth had been sprayed. The foliage has collapsed and turned brown. This illustration emphasises the difficulty of detecting infestations from a boat on the lake because of the dense raupo growth screening them.

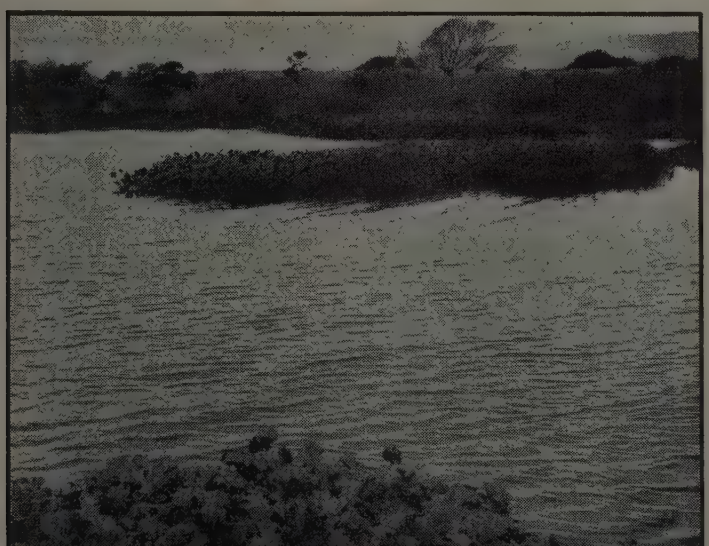

Fig. 3—Thriving masses of water hyacinth in the same lagoon as shown in Fig. 1 but further along the point of land on which St. Faith's Maori church stands. Here the water was just tepid. Of all the infestations in the Rotorua district those shown in Figs. 1 and 3 were the only ones occurring in water relatively free from excessive weed growth.

The first infestation to be tackled was the large one in the lagoon at Ohinemutu. The work was tremendously hard and tiring for the men engaged on it, some conception of the magnitude of the task being gained from the fact that on this occasion 11 large truck loads of dripping wet hyacinth were manhandled from water to boat, boat to shore, shore to truck, and truck to dump before being finally disposed of.

In succeeding weeks and months all other known infestations were taken in hand and dealt with in a similar fashion to that at Ohinemutu. By the end of 1950 all of these areas had been gone over once, but unfortunately it soon became only too apparent that once was not sufficient, for any small pieces left unnoticed in the first drag very quickly provided enough growth for subsequent operations of a like nature. Thus, up to March 1952, follow-up work was continued as necessary, but in spite of this it appeared as though the struggle for complete control of the weed would last for years.

In September 1951 the Rotorua County Council was approached by the Department of Agriculture to see whether, in view of the fact that it already administered the Noxious Weeds Act within the county, it was prepared to accept responsibility for the control and eradication of water

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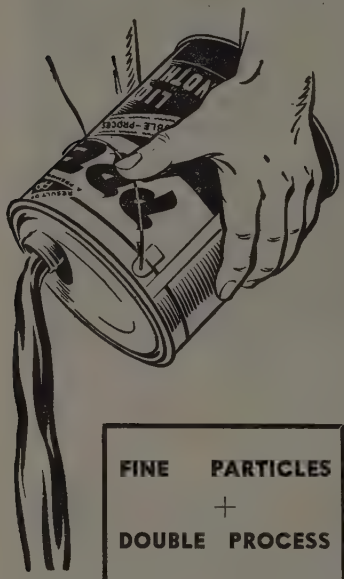

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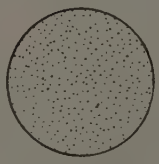

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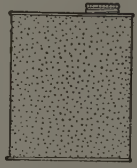

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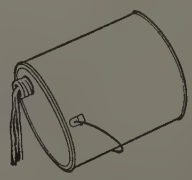

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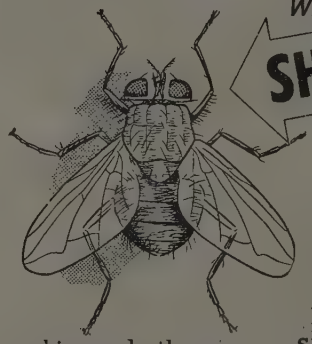

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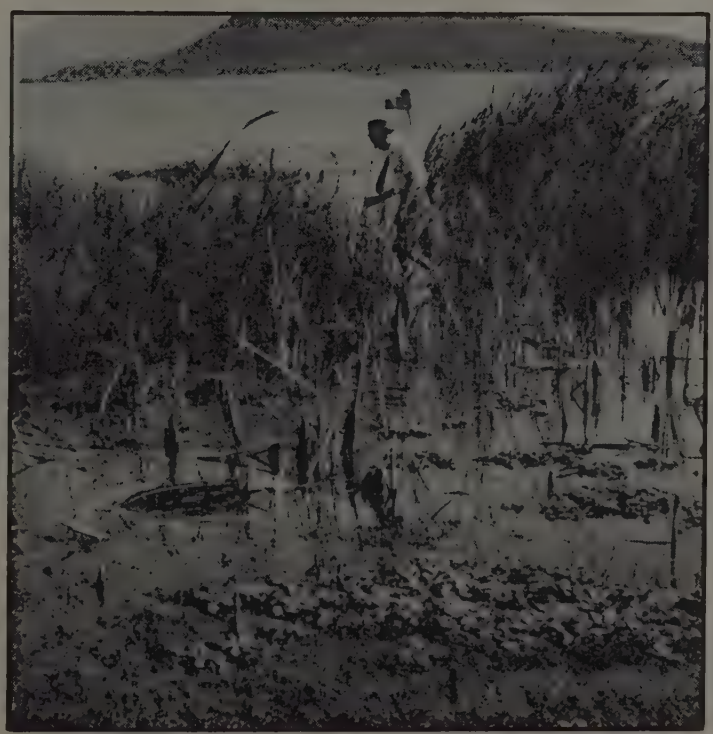
Fig. 5 (above)—Typical site for the establishment of water hyacinth on Lake Rotorua. The entire area occupied by raupo, rushes, grasses, and other vegetation is boggy and every inch of it has to be explored to find the weed. Men have to wear waders—gumboots are useless—and carry knapsack outfits when spraying. Fig. 6 (below)—Water hyacinth is associated mainly with shallow cold water, mud, raupo, and rushes. In these circumstances plants are often difficult to locate and are still more troublesome to treat. In the area shown are patches of hyacinth and many hundreds of small individual plants scattered about.

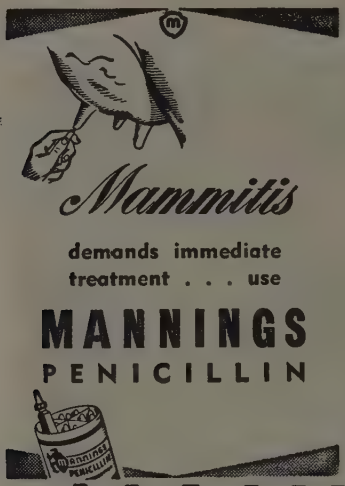
hyacinth on Crown property provided a grant for the work could be arranged. To this request a favourable reply was later received and a small grant (£50) was made to meet expenses to the end of March 1952. In this way the Department of Agriculture, which hitherto had been responsible for carrying out the task of hyacinth eradication in Rotorua, passed to the county council full authority to proceed with this work on behalf of the Crown.

Spraying with Hormones

By this time a few additional areas of infestation had been found and these together with the old ones the county council took in hand early in March 1952. The original method of dragging the weed was continued for a time, but increasing difficulty in securing men willing to take on this back-breaking and altogether unpleasant job caused other methods of control to be considered. Among these, spraying with the new hormone weedicides was fully investigated.

The final result of many trials indicated that the oil-based ester of 2,4-D (Weedone 57, Stantox P44, Ethone, Ataweed, Yates 2,4-D Concentrate, etc.) used with diesel fuel at a concentration of 1 : 80 gave by far the best kill of water hyacinth. In fact, so satisfactory was this treatment with plants of normal growth that one thorough spraying applied at any time between December and April was found completely effective without subsequent follow-up treatment. Where growth was extraordinarily vigorous and dense, such as in the warm lagoon at Ohinemuti, it was





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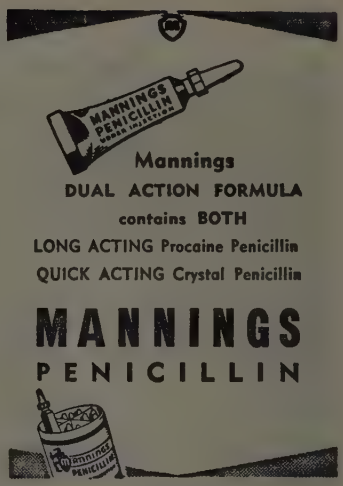

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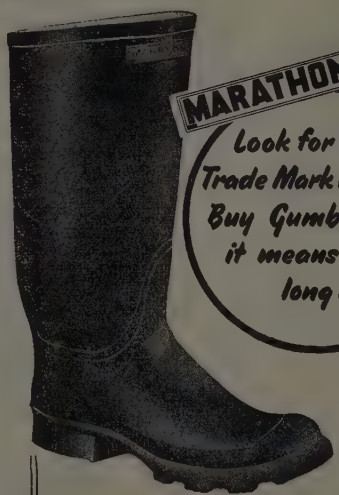

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Fig. 7—Section of a large infestation of water hyacinth which was sprayed with the oil-based ester of 2,4-D and diesel fuel 2 weeks before the photograph was taken. All that is left of the original plants is a decaying mass of inflated petioles. A year later a follow-up treatment was applied to catch the odd plants that escaped the first spraying. Inset—As long as people see in water hyacinth only a flower of exquisite beauty and fail to appreciate the dangerous characteristics of the weed, it must remain a potential menace to low-lying farmlands and drainage systems throughout, at least, Auckland Province. Naden Matthews photo.

found that at least two sprayings were necessary—the first to kill the top growth and the second, applied 2 or 3 weeks later, to deal with the underlying vegetation, which remained virtually untouched by the original spray application. Provided these sprayings were done thoroughly, as they invariably were, further treatment was rarely needed, except perhaps the gathering up by hand of a few stray plants that had been either missed by the spray or incompletely killed by it (Fig. 7).

Good Clearance but Care Needed

Today, just over 2 years since the spraying method of eradication was first used at Rotorua, known infestations of the weed have been so reduced as to be virtually eliminated. Great care is still required, however, to see that a flare-up does not occur and to this end regular inspections are made of the sites of all old infestations. In addition investigation is made at less frequent intervals of every locality likely to offer the weed a sanctuary; nevertheless with all this thoroughness it is still quite possible to miss some small infestations owing to the tremendous amount of cover offered to plants by the lush growth of raupo, rushes, and other grasses and weeds with which hyacinth associates.

For this reason members of the public who use the lakes and streams of Rotorua in any way (fishing, boating, or sightseeing) or who live close to the shores of these waters will be performing a valuable public service by reporting all observed infestations to the Rotorua County Council or the Rotorua office of the Department of Agriculture.

Cost of Eradication

The extreme menace of water hyacinth in such situations as it was found in Rotorua, where easy escape to the drainage systems of farms and other properties in Bay of Plenty region is possible, is only matched by the heavy expenditure necessary in preventing the weed from doing so. In Rotorua alone from July 1950 to 30 June 1954 a total of £464 11s. 5d. (excluding administration charges) was spent in fighting **the progeny of possibly only one small plant** originally set in or near the lake a few years ago by some thoughtless person because he or she liked its pretty flower and delicate foliage. Unfortunately the temptation to repeat this action is just as great today as it was then and will remain so for as long as people stay ignorant of the dangerous characteristics of water hyacinth and see in it only a plant of exquisite beauty.

This article will serve its purpose if it contributes even a small measure of enlightenment about the potentialities for evil of the seemingly attractive water hyacinth plant.

Acknowledgments

The writer wishes to acknowledge the excellent co-operation and assistance received from Messrs. R. S. Martin and W. W. Williams (engineer and inspector respectively of Rotorua County Council) in dealing with water hyacinth from the time their council took over its control. To the borough council's former engineer, Mr. H. Truman, and foreman, Mr. S. J. Sergeant, thanks are also due for much assistance and helpful advice during the early years of this work.

Molybdate Topdressing and Animal Health

By I. J. CUNNINGHAM, Superintendent, Department of Agriculture Animal Research Station, Wallaceville

MOLYBDENUM is unquestionably a trace element of special interest in New Zealand, because some areas are deficient in molybdenum while other areas have too much. On the deficient areas molybdenum must be added as a fertiliser to grow good pastures or crops; on the excess areas there is so much molybdenum in the fodder that stock are poisoned. This excess may get into the grass because the soil is naturally high in molybdenum, or it may get there through careless or unnecessary use of molybdate fertilisers. Thus molybdenum has on the one hand possibilities of benefiting animal production by improving fodder production and on the other hand possibilities of doing harm by poisoning animals.

Fig. 2—A typical case of peat scours caused by molybdenum poisoning.

THE main purpose of this article is to describe the harmful effects of molybdenum to stock and to show in what places and why molybdate fertilisers should not be used, but to make sure that the matter is kept in its proper perspective it is proposed first to discuss briefly the benefits which can result from the proper use of molybdenum.

Molybdenum is an essential food for plants, though their requirements are very small. It is needed to convert nitrates into proteins and thus is necessary for plant growth. On soils that are deficient there will therefore be low production of pasture and low production of crops such as turnips and rape. The correct use of molybdate fertilisers on such deficient soils will greatly improve both pastures and crops.

Molybdenum is an essential food for the bacteria which grow in the nodules on the roots of legumes and which are responsible for taking nitrogen from the air and converting it to a form suitable for use by plants. Fixation of atmospheric nitrogen by clovers is very important in New Zealand grassland economy. Pastures depend in no small degree on the legume nodule to gather the nitrogen needed for growth. Clovers do not grow well on soil that is short of molybdenum and they respond spectacularly to suitable topdressing with molybdates.

There is no doubt that proper use of molybdenum on deficient soils can improve clover growth, increase nitrogen supply for clover and for grasses growing in association, and raise production of pastures and crops. In other words, molybdenum can in some districts greatly increase the supply of food for stock and consequently enhance the stock carrying capacity of the land. W. R. Lobb, Instructor in Agriculture, Department of Agriculture, Oamaru, has calculated just what this may mean on the sandstone and clay soils of the lowlands of Waitaki County. He estimates an increase of 60 per cent. in stock carrying or a potential improvement of £500,000 annual gross farm income for that county alone. When all the deficient areas of New Zealand are added the total possible increase in primary production for the Dominion is likely to be very significant.

Departmental Trials

It is obvious that molybdenum is an important fertiliser which must be exploited to the full. Farmers can be well assured that its use in New Zealand is being most actively studied. The Extension Division of the Department of Agriculture is carrying out comprehensive experiments to learn where molybdates should be used.

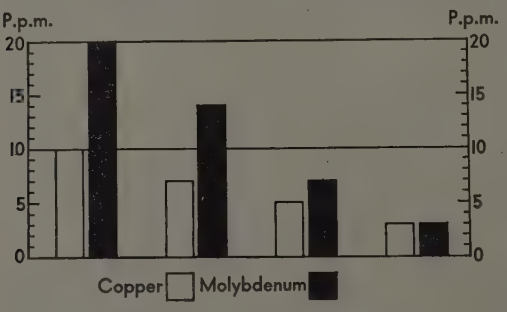

Fig. 1—Pasture levels of copper and molybdenum at which molybdenum is harmful to stock.

Two methods are employed. In the first, experimental plots are laid down by agricultural instructors on known soil types and regular observations are made of growth response to molybdate, with and without lime, phosphate, and sometimes other fertilisers. Some hundreds of trials have already been laid down throughout the country and more are being laid down almost daily.

The second method, at the Department of Agriculture's Rukuhia Soil Research Station, is due to E. B. Davies and his colleagues, who have been prominent in molybdenum work from its beginnings. They have devised a chemical test on soil by which they can diagnose adequacy or deficiency of molybdenum, and from the result of this test can give advice as to whether topdressing with molybdates is necessary.

These two lines of work and studies made by other research groups are quickly building up in broad outline the picture of molybdenum response in New Zealand.

An article by E. B. Davies and J. L. Grigg in the December 1953 "Journal of Agriculture" covers existing knowledge. Responses in growth of pasture to molybdate topdressing have been observed in soils derived from greywacke and greywacke alluvium in Southland, Otago, Canterbury, Nelson, and Westland. In the North Island responses have occurred on soils derived from greywacke on the Rimutaka, Tararua, and Ruahine Ranges and on isolated areas as far north as the Bay of Islands. Some sandstones just south of Auckland and in Northland are deficient in molybdenum, as is Te Kopuru sand in Northland.

The interpretation is that it is desirable and economic to use molybdate fertilisers on these soils.

Effect of Lime

Some other studies on molybdenum in soil are of direct interest here. Only a proportion of soil molybdenum is available to plants. Availability is greater near a neutral reaction in soil and decreases as soils become more acid. Liming brings acid soils nearer to neutrality and therefore in certain circumstances will increase available molybdenum. In Southland Davies has

noted that very high dressings of lime give unexpectedly high responses in pasture growth and he regards this as due to increases in availability of molybdenum.

This effect of lime has attracted considerable interest and has led to the belief or hope that molybdenum topdressing will replace liming. The relation of molybdate topdressing to a liming programme therefore needs some further discussion. Lime is used to reduce soil acidity, to improve soil structure, to release some plant foods from the soil, to tie up certain substances harmful to plants, and to provide a plant food, calcium. Incidentally, reducing acidity of soils may increase availability of molybdenum and thus produce an effect greater than would be expected from lime alone. In some quarters this possible secondary effect of liming on molybdenum supply is being mistaken for the whole effect of liming. It is hoped that the use of ounces of molybdenum per acre will replace the cost and difficulty of applying hundredweights or tons of lime per acre. Obviously this will not be true in the majority of cases, but in limited areas molybdenum can replace lime or reduce the amount of lime which must be used for pasture improvement.

It is clear then that there are two very valuable and economically important results from using molybdate fertilisers.

The first is to increase pasture and crop growth.

The second is to replace some of the lime needed for pasture improvement.

These results are, of course, obtained only where a molybdenum deficiency occurs.

Danger of Excess Molybdenum

The whole story has a strong appeal to the imagination of farmers. It is exciting to think that more grass can be made to grow by spreading something like a few handfuls of material over the whole of the farm, and it has an appeal to the pocket as well. Also it is not uncommon in farming circles to attribute production failures to lack of a trace mineral, and molybdenum is a trace mineral which appears to do just the right things. The consequence is an urge to use molybdenum fertilisers at increasing rates and on any area irrespective of whether there is or is not a molybdenum deficiency. Unfortunately here comes the other side of the picture. If molybdenum is used in excess or if it is used on land that is already high in molybdenum, the harmful effect on stock may be very serious indeed.

Fig. 4—Loss of coat colour in an Aberdeen Angus calf owing to molybdenum poisoning.

Poisonous effects from molybdenum have been observed in Britain, California, Florida, Ireland, Canada, and New Zealand. This article is confined to experience in this country.

To make clear what happens here it is necessary to explain first that molybdenum and copper are antagonistic to each other in the animal body. Molybdenum is poisonous, but within limits copper neutralises this poisoning. If copper in the food is low, a comparatively small amount of molybdenum is poisonous, but if copper is normal, the amount of molybdenum necessary to cause symptoms of poisoning is a great deal higher. The relative amounts of copper and molybdenum in the food are therefore predominantly important in determining the occurrence of molybdenum poisoning. An attempt is made to illustrate this in Fig. 1. This illustrates four sets of circumstances with the pasture copper shown as a clear column and alongside a black column representing the minimum amount of molybdenum which is poisonous in the same pasture. For a pasture with 10 parts per million (p.p.m.) of copper there must be 20 p.p.m. or more of molybdenum to cause poisoning. For lower levels of copper the minimum harmful level of molybdenum is lower. When pasture has 5 p.p.m. of copper molybdenum is toxic at only about 7 p.p.m., and when pasture copper is 3 p.p.m. molybdenum is toxic with only 3 p.p.m. These figures are not to be regarded as final, but as a general indication reached from field and experimental observations.

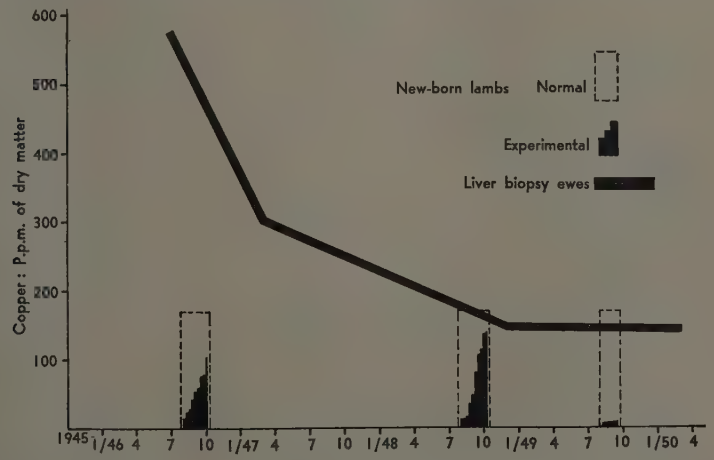

Fig. 3—Graph showing how molybdenum in the food reduces liver copper in ewes and their lambs.

Much of the knowledge of molybdenum poisoning in New Zealand relates to peat scours, which is caused by pasture the composition of which conforms to the two middle sets of symbols in Fig. 1. The copper in the grass is between 5 and 7 p.p.m. and molybdenum varies from 8 to 16 p.p.m., that is, just enough to be poisonous.

The effect of this poisoning in stock is marked. Cattle scour severely and persistently in spring and sometimes in autumn. They lose condition and production falls. Young animals do not grow properly and bones are brittle and many have fractures from quite small knocks. The type of scouring is illustrated in Fig. 2.

Proof that molybdenum is the cause of these symptoms follows from:—

1. The occurrence of a seasonal variation of molybdenum content of pasture with peak molybdenum content at seasons when scouring occurs.
2. The reproduction of symptoms by dosing molybdenum to cattle and

by grazing cattle on pastures top-dressed to reproduce the levels of copper and molybdenum that occur in natural cases.

However, molybdenum poisoning is not confined to peat scours. Continuing investigations have shown that in cattle and sheep too much molybdenum in the diet will wash out stores of copper and produce a copper deficiency. An example of what happens in sheep is given in Fig. 3, which summarises the results with a group of 12 ewes kept on grass with copper content of around 10 p.p.m. and dosed regularly with molybdenum so that the molybdenum intake represented about 30 p.p.m. of the food eaten. The dosing started in October 1945 and continued until 1950. The thick black line is the average amount of copper in the ewes' livers, measured on small pieces of liver removed at different times. The steady drop in copper content of the ewes' livers is clearly evident. The black stepped symbols indicate the copper contents in livers of newborn lambs; these are enclosed in a dotted column which shows the normal values for lambs' livers at Wallaceville. Even in the early part of the experiment some of the newborn lambs from ewes dosed with molybdenum had low copper contents in their livers, and at the end of the experiment all such lambs had very low copper in the livers.

The same train of events occurs with cattle. Ten yearling heifers were kept on pasture containing about 10 p.p.m. of copper. Five of these were dosed with molybdenum to give about 30 p.p.m. in the food. At the end of 81 weeks the untreated cattle had on the average 96 p.p.m. of copper in the dried liver, whereas the dosed cattle had only 10 p.p.m. of copper in the liver. Dosing with molybdenum had obviously greatly reduced the amount of copper in the livers of these cattle.

Investigations have also shown that diseases resulting from copper depletion and associated with excessive molybdenum in the pasture occur on other soils besides peat soils. On Omihi soil and other soils in North Canterbury ataxia in lambs occurs and Merino sheep lose wool crimp. The pastures contain about 5 p.p.m. of copper and about 9 p.p.m. of molybdenum.

On pumice soils between Lake Waikaremoana and Wairoa young cattle are copper deficient, unthrifty, and show a marked loss of coat colour. The pastures have about 7 p.p.m. of copper and nearly 20 p.p.m. of molybdenum. A similar condition affects cattle in Raglan County. The appearance of the Wairoa cattle is illustrated in Fig. 4.

All these circumstances show clearly that excess of molybdenum is extremely dangerous to stock health. Great care must therefore be exercised in using this element as a fertiliser. However, a warning to be careful is not by itself very helpful, and it is necessary to be specific about:—

1. The areas where molybdenum content of pasture is so high that molybdate fertilisers should on no account be used.
2. The areas where copper in pasture is low, because in these areas increases in molybdenum of pasture is especially likely to be harmful.
3. The areas where molybdate top-dressing produces an abnormally high response in molybdenum content of pasture. In such areas a small dressing might convert a safe pasture to a dangerous one.

A certain amount of information on the first two points had already been accumulated, but this had to be expanded to give a reasonable cover of the Dominion. To do this quickly and with the facilities available it was necessary to have some basis for generalisation, and for this soil type was selected. Samples of pasture were collected from all the main soil types in New Zealand in the spring of last year, since spring is the season for maximum level of molybdenum in pasture. Analyses of these pastures for copper and molybdenum show which soils grow pastures high in molybdenum and which grow pastures low in copper.

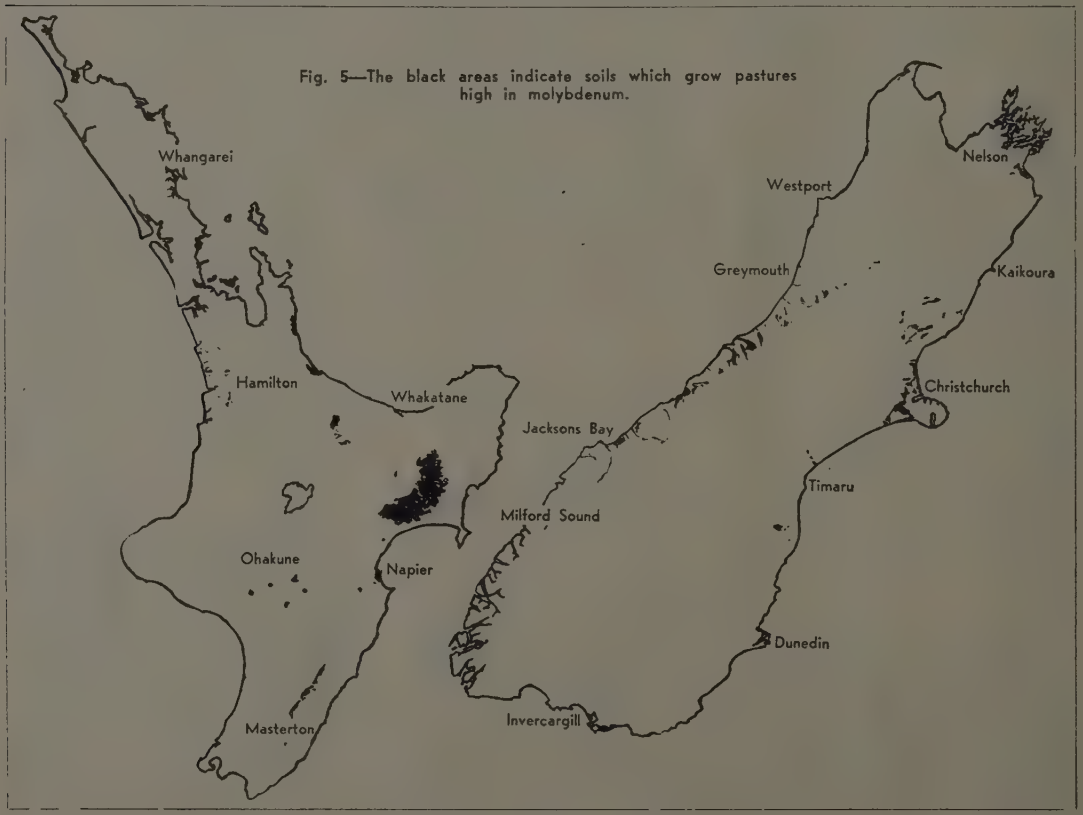

Fig. 5—The black areas indicate soils which grow pastures high in molybdenum.

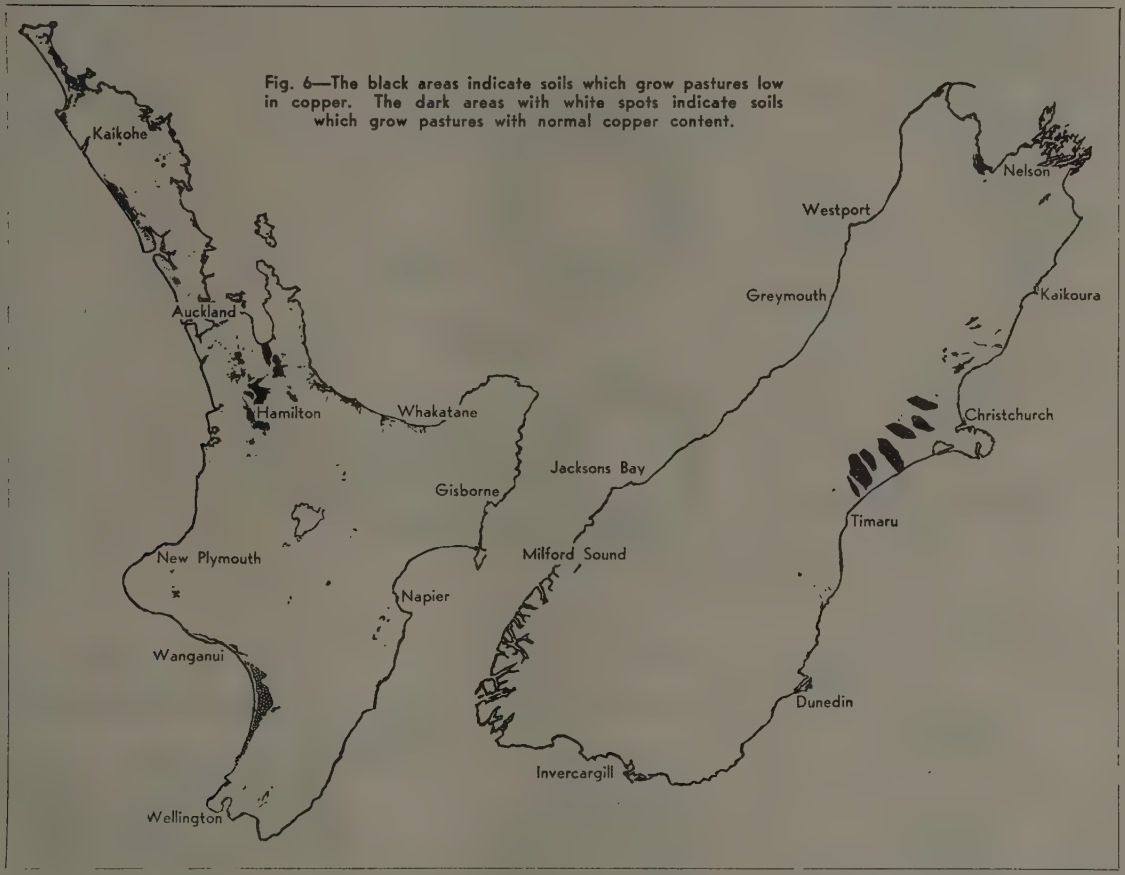

Fig. 6—The black areas indicate soils which grow pastures low in copper. The dark areas with white spots indicate soils which grow pastures with normal copper content.

The results of this work are discussed here.

For measuring the response in pasture molybdenum to molybdate topdressing two methods were used. The first was to collect experience from a variety of topdressing trials with different rates of topdressing. The second was to obtain pasture samples from trial plots laid down by agricultural instructors to measure response in growth rate to molybdate dressings. From each trial a sample came from the untreated area, from the area topdressed with molybdate, and from the area topdressed with lime and molybdate.

In assessing the results of surveys or of topdressing the following criteria are used to judge the relation to animal health.

Copper—Low: Below 5 p.p.m.

Molybdenum—Normal: Below 3 p.p.m. Moderate: 3 to 10 p.p.m. (dangerous if copper low). High: Above 10 p.p.m. (potentially dangerous, even with normal copper).

Pastures High in Molybdenum

Table 1 lists soils which grow pastures high in molybdenum without any additions of molybdate fertilisers.

This list is not to be regarded as complete, as further work in progress may add to it. On the North Island list Taupo silt and Taupo silt loam require some comment. Only the area of soil of these types near Wairoa is affected; the main bulk of Taupo soils produces a safe grass. The reason for this difference is probably a difference in origin of soils, despite close physical similarity.

Locations of the soils included in Table 1 are indicated by the black patches shown in Fig. 5, except South Island peats, for which maps are not readily available at present. All of these soils produce pastures too high in molybdenum and on many the molybdenum is so high that stock disease

TABLE 1—SOILS THAT GROW PASTURE WITH MORE THAN NORMAL MOLYBDENUM
(N = normal; M = moderate; H = high)

Soil name	Soil classification number	Pasture molybdenum Class	Pasture molybdenum p.p.m.
North Island			
Rotomahana sandy loam ..	3, 3H, 3a, 3aH	M	4-9
Konoti clay loam	7bH	M	4-6
Taupo light silt loam } ..	Near Wairoa		
Taupo sandy silt }	only	H	13-19
Tutira sandy loam	49a	N-M	1-4
Whangamata sandy loam ..	53	N-M	2-3
Hastings clay loam	63cL	M	5-7
Meeanee-Farndon complex ..	111	M	3-5
Ahuriri Lagoon soil	112, 112a, 112b	M-H	6-11
Taihape silt loam	114a	N-M	1-7
Turakina silt loam	114b	N-M	2-6
Waitaha sandy loam ..	114c	N-M	2-4
Mahoenui silt loam	115	N-M	1-9
Pahiatua silt loam	115a	N-M	1-4
Hangaroa sandy loam ..	115b	N-M	1½-8
Waihua stony sandy loam and sandy silt	117d	M	5
Peat soils	117	M-H	4-20
South Island			
Motukarara saline sandy loam and silt loam ..	—	M	5
Omihi silt loam	—	M-H	3-12
Waikakahi silt loam ..	—	N-M	1-8
Harihari fine sandy loam* ..	—	M	5
Kini peat*	—	M	4
Taitapu silt loam*	—	M	4
Huihui sandy loam*	—	M	4
Peat soils	—		

* Further data required before soils can be included as types that produce high molybdenum pasture.

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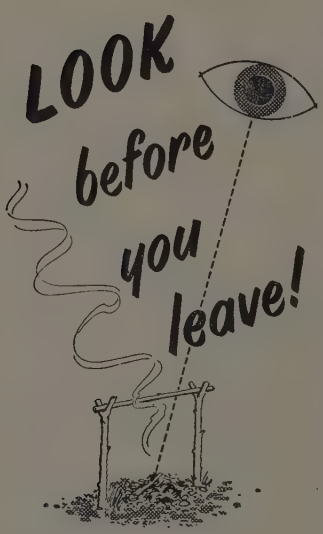

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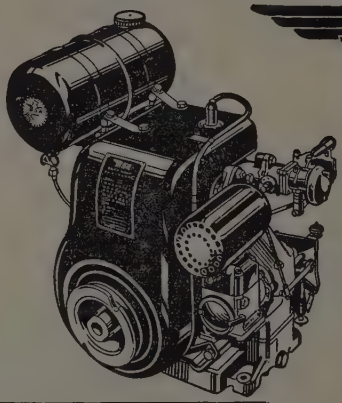

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is now occurring. Quite obviously molybdate topdressing should not be applied on any of these soils.

Pastures Low in Copper

Table 2 lists the soils that produce pastures low in copper and the location of these soils is shown in Fig. 6.

TABLE 2—SOILS THAT GROW PASTURES OF LOW COPPER CONTENT

Soil name	Soil classification number	Pasture copper p.p.m.
North Island		
Te Kopuru sand ..	47d	1-5
Marsden sand ..	23c	3-8
Whananaki, Patea, and Foxton sands	23b and 23	4-10
South Island		
Lismore silts ..	—	4-9
Moutere clay ..	—	4-4.5
Glasnevin series ..	—	2.5-7
Oamaru complex ..	—	3.7-5
Omihi silt loam ..	—	3-5
*Fairhall silt loam ..	—	4

* More information required before final decision.

For the most part these soils grow pastures with less than 5 p.p.m. of copper. But there is some variation, as is indicated by the figures shown in Table 2, and in some of the North Island sands (types 23 and 23b) many of the pasture samples have normal copper contents. These are shown in Fig. 6 as black areas with white dots, and the soils that nearly always produce low copper pastures are shown as unmodified black.

The low copper is not necessarily enough on its own to cause stock disease, but it is so low that topdressing with molybdenum could well bring on trouble in animals. Clearly molybdate fertilisers cannot be used on any of these soils without risk. If molybdenum must be used to secure good pasture growth, copper fertilisers would have to be applied at the same time to protect stock health.

Pastures Showing Abnormal Responses to Molybdate Topdressing

Pastures on different soils respond differently in molybdenum content to a topdressing with molybdate. This is illustrated in Table 3, which shows, for a variety of soils, the molybdenum content of pasture at different intervals after dressings of different amounts of molybdate.

It is apparent from this table that pastures on different soils respond differently in molybdenum content to topdressings with molybdate. For example, 12 months after treatment with 4oz. per acre pastures on Kauru silt loam were six times as high in molybdenum as untreated pastures from the same soil; and pastures on Lismore silt loam were only 4 times as high as untreated pastures a few months after topdressing with 6oz. per acre. Pastures on Waiareka clay loam were no higher in molybdenum than treated pastures 24 months after topdressing with 2½oz. per acre, whereas pastures on Crownthorpe sandy loam were definitely higher 17 months after a similar treatment. Pastures on Heretaunga mottled silt loam had nearly 19 p.p.m. of molybdenum 3 months after a dressing of 8oz. of molybdate per acre, and pastures on Warepa-like silt loam at Invermay contained only 3.8 p.p.m. from the same topdressing after the same interval. Some pastures reach a high level of molybdenum from comparatively small dressings of molybdate. Two ounces of molybdate per acre raised pastures on Heretaunga mottled silt loam to 6.9 p.p.m., and three dressings of 2oz. within 2 years raised Flock House sandy soils to 11 p.p.m. This dressing of three lots of 2oz. in 2 years is higher than would ever be recommended but not higher than might be applied by careless farmers.

Fig. 7—Soils of the North Island which after topdressing with molybdate give abnormally high levels of molybdenum in the pasture.

Table 3 thus shows two things. High or repeated dressings with molybdate will raise pasture molybdenum to dangerous levels, and responses on different soils are very different. Because of these different responses it was necessary to make measurements on a number of soil types to learn which are the soils on which abnormally high response in pasture molybdenum occurs after molybdate topdressing. A content of 3 p.p.m. or more of molybdenum in pasture 3 months after topdressing was regarded as a high response.

TABLE 3—EFFECT OF TOPDRESSING WITH MOLYBDATE ON MOLYBDENUM CONTENT OF PASTURE

Soil	Topdressing Rate/acre	Months since application	Molybdenum p.p.m. in dry grass Untreated	Topdressed
Peat	5oz. once	14	2-3	27
	14lb. once	14	2-3	300
Sand at Flock House ..	2oz. three times	24 since first	Less than 0.5	11
Crownthorpe sandy loam ..	2½oz. once	17	1.2	2.0
Kauru silt loam	4oz. once	12	Less than 1	6
Waiareka clay loam	2½oz. once	24	Less than 1	Less than 1
Lismore silt loam	6oz. once	3	0.5	2
Heretaunga mottled silt loam (Wallaceville)	1oz. once	3	1.4	4.3
	2oz. once	3	1.4	6.9
	4oz. once	3	1.4	12.2
	8oz. once	3	1.4	18.6
Warepa-like silt loam (Invermay)	1oz. once	3	1.0	1.4
	2oz. once	3	1.0	1.1
	4oz. once	3	1.0	2.6
	8oz. once	3	1.0	3.8

Information on this aspect, as already explained, was obtained by examining pasture samples from agricultural instructors' trials. Circumstances made it impossible to get samples from more than about half of the trials. These included 85 trials in the North Island and 70 trials in the South Island. A summary of the results is shown in Table 4.

TABLE 4—MOLYBDENUM IN PASTURE SAMPLES FROM INSTRUCTORS' TRIALS

North Island	
Trials	85
Pasture molybdenum above normal ..	10
Those low in copper	4
Soils which gave high response	
Waipunga silt loam	
Ohinepanea sand	
Marsden sand and peaty sandy loam	
Ohakune silt loam	
Moumahaki sandy loam	
Otane Wainuku sandy silt	
Tarawera gravel	
Esk sand	
Rissington sandy loam	
Te Kopuru sand	
South Island	
Trials	70
Pasture molybdenum above normal ..	1
Soil which gave high response	
Motukarara weakly saline sandy loam	

The first important point shown in this table is that North Island soils respond more in molybdenum content of pasture to molybdate dressings than do South Island soils.

Ten out of 85 North Island soils gave pastures with molybdenum at 3

p.p.m. or higher 3 months after topdressing. There were 12 other soils on which pasture molybdenum was high, but on these topdressing had been done less than 3 months before sampling and judgment is reserved until these plots are resampled.

In the South Island only one out of 70 trials gave an abnormally high response and this was on a soil high in molybdenum that produces high molybdenum pasture even without topdressing.

The distribution of the 10 North Island soils in Table 4 is mapped in Fig. 7. The South Island soil is not mapped because it is included among the soils in Fig. 5.

Of the 10 North Island trials that gave a high response in molybdenum, 4 were in pastures that are low in copper content. In these pastures a rise of molybdenum is more likely to be dangerous.

On only one of the soils, was the pasture growth so improved by molybdate topdressing that the instructor would recommend using molybdate fertiliser. This case is Te Kopuru sand, but this is an important case, for copper in the pasture is very low. The molybdenum content of the pasture was 3½ p.p.m. 9 months after applying 2½oz. of molybdate per acre and the copper was 3.1 p.p.m. On pasture of such composition copper deficiency and molybdenum poisoning could occur in grazing stock.

On all the soil types in Table 4 molybdate fertilisers must be used with care. It appears that the 2½oz. per acre used in these trial plots is too high and that on these soil types and indeed on the North Island in general a lower level should be employed to guard against stock disease. For soil types like Te Kopuru sand where low pasture copper accompanies high response to molybdate dressing the only safe procedure would be to combine a topdressing of copper with molybdate topdressings.

On the basis of results discussed above it is possible to make specific comments on the use of molybdate fertilisers.

1. All the soil types listed in Table 1 and shown in Fig. 5 at present produce pastures above normal in molybdenum content. Topdressing with molybdate should be unnecessary and would further raise pasture molybdenum with possibility of harm to stock health. On these soils molybdates should not be used.
2. The soil types listed in Table 2 and shown in Fig. 6 produce pastures low in copper content. Topdressing with molybdate is likely to raise molybdenum content of grass, and a raised molybdenum content of grass with low copper is especially dangerous to stock. If molybdate topdressing is necessary to improve pasture growth, copper topdressing at 5lb. of bluestone per acre should be applied at the same time to protect stock.
3. The soils listed in Table 4 and shown in Fig. 7 give abnormally high responses to a topdressing of 2½oz. of molybdate per acre. Molybdate should not be used at this rate on these soils without concurrent use of copper.
4. The high response to molybdate dressings in a big proportion of the North Island trials (Table 4 and discussion of it) suggests that 2½oz. per acre is too high for the North Island. It is probable that a lower rate of topdressing would not produce sufficient increase in pasture molybdenum to cause any concern about stock health and yet would produce adequate growth responses in pasture. Responses in the South Island are not nearly as high and on most soils of that island a rate of topdressing with molybdate higher than in the North Island could safely be employed.

(The lists of soils commented on in 1, 2, and 3 have been arrived at from a year's work only. These lists may be extended by further work proceeding at present. The results so far obtained are presented, however, as even in the present form they offer some assistance in reaching a policy on the use of molybdate fertiliser.)

5. The abnormally high responses on some soils to small rates of molybdate topdressing and the marked response to higher single dressings or repeated dressings (Table 3) point very clearly to the need to adhere closely to recommended rates of molybdate.

Despite the discouraging outlook that these results might engender, they should not in any way be interpreted as suggesting that molybdate is unsafe where a deficiency exists. Molybdenum is a very valuable fertiliser and its correct use can be of great value. Careless and irresponsible use on the other hand can be harmful. This article shows where molybdates should not be used. Agricultural instructors in each district can, if necessary, give farmers information on the soil types on their farms and can tell them where molybdate should be used and the amount it is safe to employ.

Dual-purpose Gate for Woolsheds

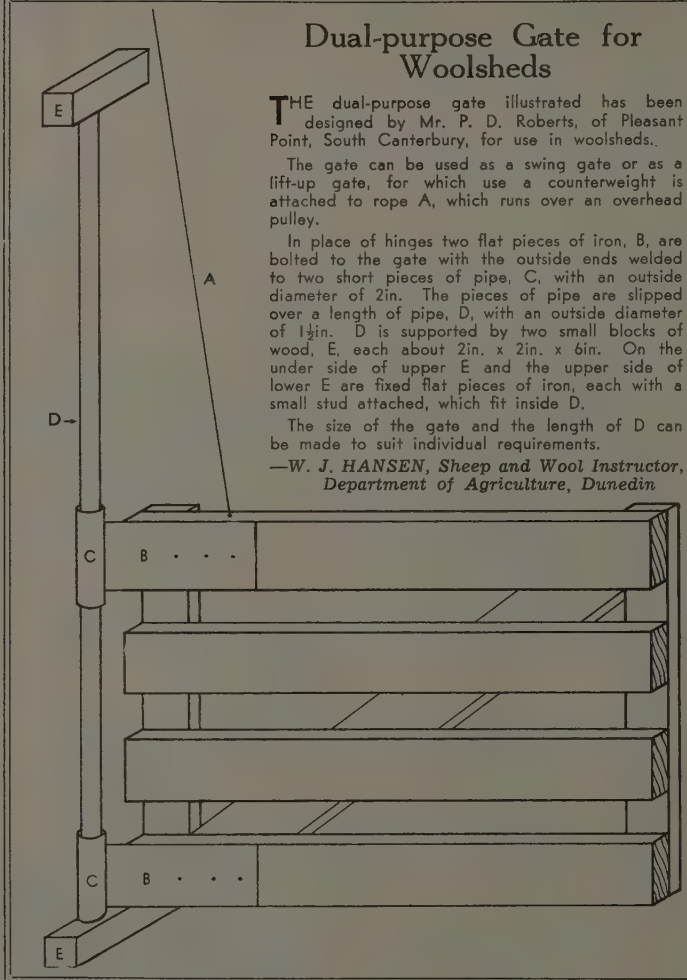
THE dual-purpose gate illustrated has been designed by Mr. P. D. Roberts, of Pleasant Point, South Canterbury, for use in woolsheds.

The gate can be used as a swing gate or as a lift-up gate, for which use a counterweight is attached to rope A, which runs over an overhead pulley.

In place of hinges two flat pieces of iron, B, are bolted to the gate with the outside ends welded to two short pieces of pipe, C, with an outside diameter of 2in. The pieces of pipe are slipped over a length of pipe, D, with an outside diameter of 1½in. D is supported by two small blocks of wood, E, each about 2in. x 2in. x 6in. On the under side of upper E and the upper side of lower E are fixed flat pieces of iron, each with a small stud attached, which fit inside D.

The size of the gate and the length of D can be made to suit individual requirements.

—W. J. HANSEN, Sheep and Wool Instructor, Department of Agriculture, Dunedin



Recipes Requiring Milk

IT is one thing to know the value of and necessity for adequate quantities of milk in the diet, but quite another thing to ensure that all people, children particularly, take sufficient milk each day. In New Zealand consumption of milk is seldom limited because of the cost of the milk. Frequently it is a question of likes and dislikes. Some people drink milk readily; for others it must be disguised in flavour and appearance. For such as these and as an indication of how milk may be made a general part of the diet, the following suggestions by Maud B. Strain, Field Officer in Rural Sociology, Department of Agriculture, Dunedin, should be useful.

THE importance of an abundance of milk in the diet, especially children's diet, cannot be over-emphasised. Besides containing most of the dietary essentials—protein, fat, carbohydrate, minerals, vitamins, and water—it is the most important source of one mineral, calcium, without which it is impossible to have sound bones and teeth. However, calcium by itself is not enough; to do its job properly it must have the assistance of vitamin D, which, with other important vitamins, is also present in milk. Thus two of the essential constituents of healthy bones and teeth are supplied together in milk. Indeed it is practically impossible to have an optimum amount of calcium in the diet without using milk or milk products.

The food value of skimmed milk is only slightly less than that of whole milk. Cream and butter, though excellent sources of fat and vitamins A and D, are not satisfactory substitutes for milk.

There is infinite variety in the ways in which milk may be used in the diet, as for example:—

In drinks: Cocoa and the many cocoa preparations, coffee, milk shakes in all their variety of colour and flavour, and egg flips.

In sauces: White sauce and its sweet and savoury variations.

In soups: All varieties of "cream" soups.

In batter mixtures: Yorkshire pudding and variations, fruit batters, and fritters of all kinds.

In milk puddings: Rice, sago, tapioca, etc.

In custards: Sweet and savoury.

In desserts: Junket in various colours and flavours, blancmange, spanish cream, lemon meringue pudding, and chocolate queen pudding.

In the following recipes all measurements are level.

Drinks

Cocoa, being starchy, is improved in flavour and digestibility by being boiled. A cocoa paste which requires only the addition of hot milk and which keeps for weeks is handy where there are children. A variety of preparations containing cocoa, sugar, malt, and milk powder and requiring only hot milk or milk and water, is quickly prepared but more expensive. Egg flips are particularly advantageous, because the egg adds extra nutriment, supplies iron (in which milk is deficient), and, being in the raw state, is very easily digested.

Cocoa

2 to 3 tablespoons of cocoa
¼ pint of water
1 quart of milk
1 to 2 tablespoons of sugar
⅛ teaspoon of salt

Mix cocoa and sugar together, add water, preferably hot, and boil for 5 minutes; add salt. Scald the milk in a double boiler, add the cocoa mixture to it, and stir until well blended. Beat the cocoa with a rotary egg beater to make it foamy before serving. A teaspoon of whipped cream or a marshmallow may be served with cocoa.

Cocoa Paste

4oz. of cocoa
4oz. of sugar
1 pint of boiling water

Mix cocoa and sugar together and add boiling water gradually. Boil for 5 minutes, stirring all the time; cool and store in screw-topped jars. Use 1 or 2 teaspoons of cocoa paste to each cup of milk.

Milk Shake

1 cup of milk
1 teaspoon of sugar
2 tablespoons of fruit syrup

Beat the ingredients well with a rotary egg beater; milk froths more readily when ice cold.

Egg Flip

1 egg
Pinch of salt
2 teaspoons of sugar
1 cup of milk
2 tablespoons of fruit juice

Beat the egg and add salt, sugar, and fruit juice. Pour into a glass and add the milk. The fruit juice may be omitted and a little ground nutmeg sprinkled on top of the milk.

White Sauce

White sauce is the basis of many cookery dishes, both sweet and savoury. It is essentially milk thickened with flour or cornflour, butter being added to improve the flavour, appearance, and food value. The proportion of flour to milk varies, depending on the thickness of sauce required; this in turn depends on whether the sauce is to be used as such or as a foundation for some other dish. There are two common methods of making white sauce:—

Roux method: Melt butter, stir in flour, and, if a savoury recipe, seasonings. Cook for a minute without

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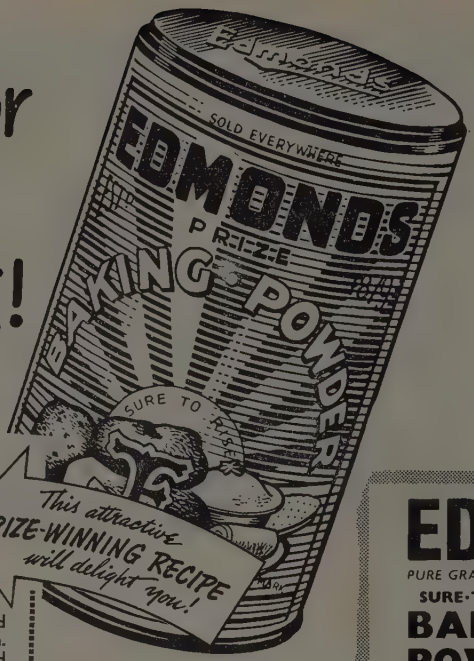

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2oz. honey, 1oz. sugar, 2oz. butter, 2oz. flour, 1 teaspoon EDMONDS BAKING POWDER, ½ teaspoon ground ginger.

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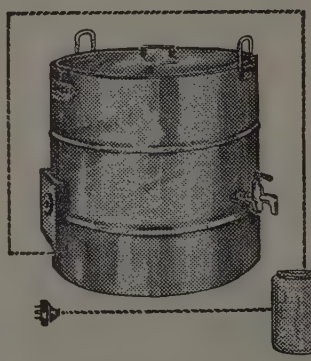

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browning. Add a small quantity of milk and, if a sweet sauce, add sugar; stir until smooth and free from lumps. Add more milk and stir again until all the milk is added, being careful each time to have the mixture smooth before adding further milk. Boil for 3 to 5 minutes.

Hot-mix method: Heat the butter, seasoning, and most of the milk in a saucepan, keeping back just sufficient milk to mix the flour to a thin, smooth cream. Pour the hot milk on to this mixture, stirring well to prevent lumps. Return to the saucepan and boil for 3 to 5 minutes.

Proportions of Fat and Flour to ½ Pint of Milk in White Sauce

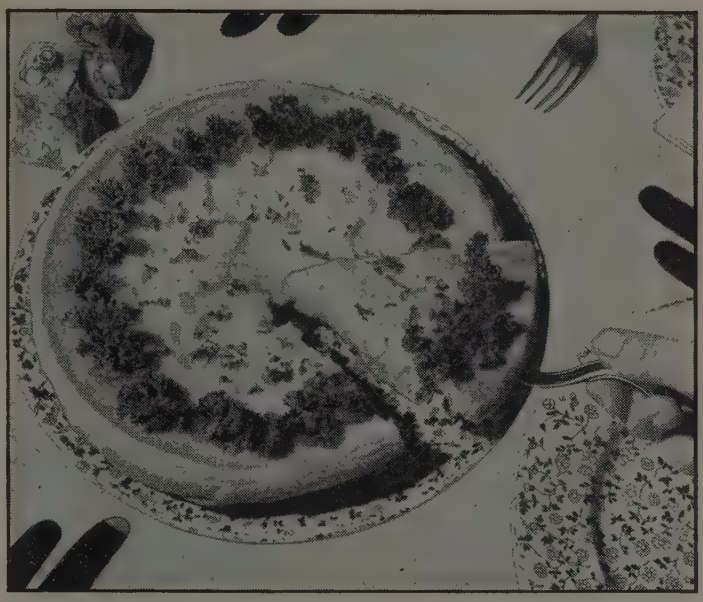
	Flour	Fat
Very thin ..	½ tablespoon	1 tablespoon
Thin	1 tablespoon	1 tablespoon
Medium ..	2 tablespoons	2 tablespoons
Thick ..	3-4 tablespoons	2 tablespoons
Very thick ..	6-8 tablespoons	4 tablespoons

Very Thin White Sauce

Very thin white sauce is used with soups having a large amount of starchy material as in pea, potato, or asparagus soup. Though the vegetable pulp alone gives sufficient thickening, the soup on standing separates into two layers; the addition of a small amount of white sauce stops this separation.

Standard Cream Soup

2 tablespoons of flour
2 tablespoons of butter
2 pints of milk or half milk and half vegetable water
2 cups of cooked, sieved vegetable pulp
Salt, pepper, and other seasonings



Cheese pie hot makes an appetising tea dish on a cold night, but is equally acceptable cold.

Make a very thin white sauce with the flour, butter, and liquid. Cook for 5 minutes. Add vegetable pulp and seasonings and reheat. The following may be substituted for the vegetable pulp:—

Peas: Leave 1 cup of cooked peas whole.

Celery, asparagus, or onion: Add cooked, sieved vegetable.

Potato and onion: Add 1 cup each of potato and onion and some chopped parsley.

Mixed vegetable: Add 1 cup of diced and 1 cup of cooked, sieved vegetable; diced carrot and whole green peas give an attractive colour.

Thin White Sauce

Thin white sauce is used for soups made from non-starchy foods, as for example:—

Oyster: Substitute strained oyster liquor for part of the milk. Put 2 or 3 prepared oysters in each warmed soup plate and pour the hot soup over them. Serve immediately.

Tomato: Add hot, cooked, sieved tomato to thin white sauce, stirring carefully, and serve at once. It is liable to curdle on standing or when reheated.

Shellfish: Add minced, cooked, toheroa, pipi, or other shellfish to thin white sauce. In making the sauce substitute for part of the milk some of the liquid in which the shellfish was cooked (carefully strained to remove any sand).

Medium White Sauce

Medium white sauce is used for serving with vegetables and with meats and also as a sweet sauce with steamed puddings. Sauces made for

Oyster patties, which are filled with a thick white sauce-oyster mixture, are always popular at any cocktail or supper party.

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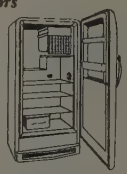
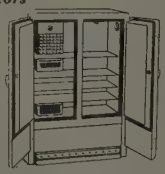


7.9 cu. ft. model with large Super Freezer, separate meat compartment, door shelves, "Quickube" ice trays, hydrator, "Meter-Miser".

Refrigerators for farm or guest house like this



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serving with vegetables may have some of the milk replaced by the water in which the vegetables were cooked.

Variations are:—

Horse radish: Add ¼ cup of grated horse radish.

Caper or parsley: Add 2 to 4 tablespoons of chopped capers or parsley.

Egg: Add 1 hard-boiled, sieved egg.

Onion: Slice and cook 3 medium onions in a small amount of water. Substitute onion water for part of the milk in making white sauce. Add cooked onion, heat, and serve.

Sweet: Add 1 to 2 tablespoons of sugar.

Spice: Add 2 level teaspoons of mixed spice to roux method mixture before adding milk.

Treacle: Add 2 tablespoons of treacle or golden syrup to cooked sauce.

Brandy: Add 1 tablespoon of brandy or wine after sauce has cooled.

Medium sauce is used for scalloped, creamed, and au gratin dishes.

Scalloped dishes are made of alternate layers of white sauce and cooked vegetable, egg, fish, or shellfish covered with buttered breadcrumbs and baked at 350 degrees F. until crumbs are lightly browned and the sauce is bubbling.

Creamed dishes, for example, creamed chicken: Add chopped cooked chicken to medium white sauce, heat, and serve on toast or in pastry fingers. Salmon, crayfish, oysters, sardines, and whitebait are suitable alternatives for chicken.

Au gratin dishes are similar to scalloped dishes but are more often prepared with left-over vegetables, and ¼ to ½ cup of cheese is added to the sauce. Cover the mixture with breadcrumbs and bake at 350 degrees F. for 20 to 30 minutes.

Thick White Sauce

Thick white sauce forms the basis of souffle mixtures. Egg yolks and whites beaten separately and various flavourings are added. The pie dish or basin must not be more than two-thirds full, because the souffle expands on cooking. Souffles must be served immediately they are cooked, as they collapse if left standing.

Apricot Souffle

½ cup of pulped apricot	2 tablespoons of sugar
½ cup of thick white sauce	4 eggs

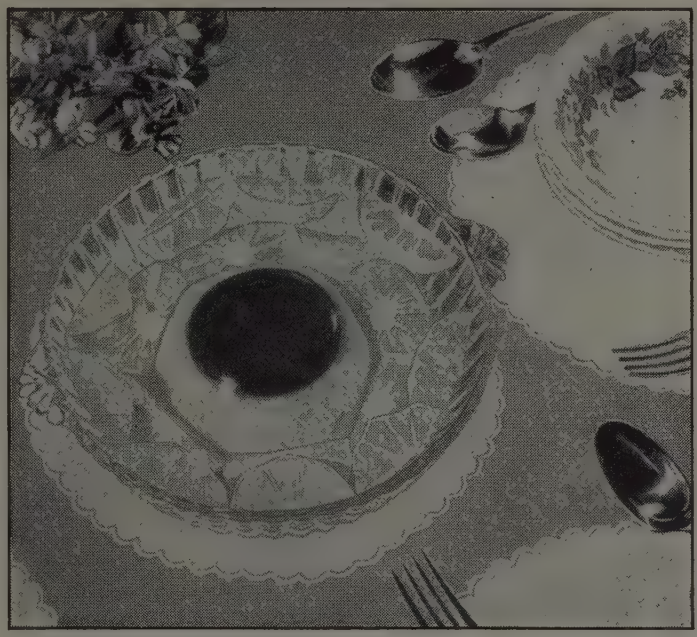
Separate the yolks and whites of the eggs. Beat the yolks and sugar until thick and creamy and add to the cooled white sauce. Add the apricot pulp and lastly fold in the stiffly beaten whites. Pour into a well-buttered basin and steam for 45 minutes or bake in a buttered pie dish set in a dish of hot water in a moderate oven (325 to 350 degrees F.) for 45 to 50 minutes or until firm to the touch.

Variations: Cheese, meat, fish, vegetable, fruit, or chocolate.

Cheese Souffle

4 tablespoons of butter	4 tablespoons of flour
½ pint of milk	4 eggs
1 cup of grated cheese	Cayenne pepper
	½ teaspoon of mustard
	1 teaspoon of salt

Make a thick white sauce, cook for 5 minutes, add cheese and seasonings, and stir until cheese is melted; then remove from heat. Separate yolks from whites of eggs and beat stiffly. Add the beaten yolks gradually to the cooled cheese mixture and lastly fold in the stiffly beaten whites. Turn into a well-greased baking dish and set in a pan of hot water in the oven at 350 degrees F. for 50 to 60 minutes or until firm and delicately browned.



This moulded custard with its cap of caramel sauce and its orange garnish makes a most attractive dessert.

Very Thick White Sauce

Very thick white sauce is used for croquettes, a palatable way of using up left-over cooked meat, vegetables, or fish. The sauce binds together the other ingredients.

Meat Croquettes

2 cups of minced, cooked meat	1 teaspoon of chopped parsley or onion
1 cup of very thick white sauce	1 tablespoon of milk or water
1 egg slightly beaten	Fine breadcrumbs

Use any left-over cooked, minced meat. Make white sauce, add meat and seasonings, and cool thoroughly. Beat the egg slightly and add a tablespoon of milk or water. Form the mixture into cylinders or small cutlets, dip in fine breadcrumbs, then in egg and then in breadcrumbs, and fry in hot, deep fat (365 to 380 degrees F.) for 2 to 5 minutes or until browned. Serve with a well-flavoured sauce, such as tomato.

Egg Cutlets

3 hard-boiled and chopped eggs	1 teaspoon of curry powder
4 tablespoons of flour	Salt and pepper
2 tablespoons of butter	Egg and breadcrumbs for coating
½ cup of milk	

Make sauce from flour, butter, curry powder, and milk. Add chopped egg and seasoning and combine well together. Cool and when cold form into small cutlets, dip in beaten egg and then in fine breadcrumbs, and fry in shallow fat, browning slightly on one side and then the other. Alternatively fry in deep fat.

Batter Mixtures

Batter mixtures vary in thickness according to the purpose for which they are used: Thin for Yorkshire pudding, pancakes, etc., thicker for fritters and coating batters, and still thicker for pikelets or gems.

Yorkshire Pudding

4oz. of flour	Pinch of salt
1 egg	Tablespoon of good dripping
½ pint of milk	

Sift the flour and salt into a mixing bowl, make a well in the centre, break the egg into the well, and stir with a wooden spoon, adding half the milk gradually. Stir until smooth, beat well for 5 minutes, and allow the mixture to stand for ½ hour. Heat the dripping in a baking dish and see that the sides are well greased with the very hot dripping. Add the remainder of the milk to the batter, pour the mixture into the hot baking dish, and cook in a moderately hot oven (400 degrees F.) for 25 to 30 minutes. The following are variations:—

Toad-in-a-hole: Skin and partly cook sausages until most of the fat has come out of them; pour in the batter and bake for 20 minutes.

Fruit batters: Proceed exactly as for Yorkshire pudding, but before pouring the mixture into the baking dish, add strawberries, raspberries, gooseberries, or peeled and sliced apples, etc.

Milk Puddings

Rice, sago, and tapioca are popular for baked milk puddings. Allow 1½oz. of one of them and 1oz. of sugar to 1 pint of milk. Bake very slowly at 250 to 300 degrees F., stirring frequently during the early stages to prevent a skin forming on the surface. Allow 2 hours for rice and 1½ hours for sago and tapioca. Tapioca cooks more evenly if allowed to soak for 1 to 2 hours before cooking. The recipe may be varied by adding sultanas or raisins or one of the following:—

Coconut: ½ cup of coconut spread on top a few minutes before cooking is finished.

Flavourings: Grated lemon rind or stick cinnamon.

Caramel: Caramelised sugar instead of plain.

Chocolate: ½oz. of melted chocolate and ½ teaspoon of vanilla essence stirred into the milk.

Caramel

Caramelised sugar: Heat sugar in a thick-bottomed saucepan over gentle heat until it browns slightly. It must be in a thin layer and must be watched carefully and stirred if necessary to prevent burning.

Caramelised sugar can be dissolved in milk for milk puddings or "boiled" custard or may be run evenly round the sides of a pudding basin in which a custard or steamed pudding is to be cooked.

Caramel syrup: This keeps satisfactorily if stored in a covered jar in a cool place. Melt 1 cup of sugar in a heavy frying pan over low heat until light brown. Add very slowly ½ cup of boiling water and boil until caramel is all dissolved. Use as flavouring.

Desserts

Junket is one of the most simply made milk desserts.

Junket

1 pint of fresh milk — Rennet according to maker's instructions
2 teaspoons of sugar

Heat milk, which must be fresh, and sugar to blood heat, stir in the rennet (usually about ½ teaspoon), and immediately pour the junket into the dish from which it is to be served. Variations are as follows:—

Caramel: Add 1 tablespoon of caramel syrup instead of sugar.

Chocolate: ½oz. of chocolate should be melted and stirred into warm milk before rennet is added.

Coffee: 2 teaspoons of coffee essence or 2 tablespoons of coffee infusion should be added to milk and warmed.

Custards (Sweet and Savoury)

Sweet "Boiled" Custard

1 egg — ½ teaspoon of vanilla essence
½ pint of milk
1 tablespoon of sugar — Pinch of salt

Beat the egg and add milk, sugar, and salt. Heat in a double boiler or in an enamel jug standing in boiling water in a saucepan. Stir all the time, preferably with a wooden spoon. When the mixture coats the spoon remove the jug at once from the boiling water, cool, and stir in the vanilla.

Baked Custard

Ingredients and method are the same as above. Pour into a pie dish standing in hot water in a baking dish in the oven and bake until set.

Moulded Custard

If the custard is to be stiff enough to turn out and still retain its shape when cooked, use only half the quantity of milk in the sweet "boiled" custard recipe. The other ingredients are the same as for that recipe.

Variations are as follows:—

Coffee: Use half milk and half strong coffee infusion.

Caramel: Caramelise the sugar and dissolve it in the milk before making the custard.

Chocolate: Melt ½oz. of chocolate; add 1 tablespoon of sugar dissolved in 1 tablespoon of boiling water and ½ teaspoon of vanilla. Mix these with the milk and use for making the custard.

"Boiled" custard may be served in custard glasses and garnished with whipped cream and bright coloured jelly or with fresh or stewed fruit. It may be poured over sponge cake as in trifle or used as a basis for many gelatine desserts (spanish cream) or as a foundation for ice cream.

Savoury Custard

1 cup of milk — 2 to 4oz. of bacon
2 eggs — Seasoning

Beat eggs well and add seasoning, milk, and bacon cut into small pieces. Pour into a buttered pie dish and stand the mixture in hot water in the oven (350 degrees F.) until set (about 40 minutes). The mixture may also be baked in a pastry shell. Line fireproof pie plate with puff pastry, pour in the custard, and bake until set and lightly browned.

Cheese Custard

1 cup of breadcrumbs — Salt, pepper, and cayenne pepper
1 cup of grated cheese — 1 cup of milk
2 eggs

Soak the breadcrumbs in the milk; add well-beaten eggs, seasonings, and grated cheese. Bake at 350 degrees F. until set and slightly browned on top.

Cheese Pie

4oz. of grated cheese — 1 tablespoon of melted butter
½ pint of fresh milk
Pastry — 2 eggs

Beat the eggs well, add the cheese, butter, and milk, and mix well together. Line a pie dish with pastry and pour in the mixture. Bake in a hot oven (450 degrees F.) for 10 minutes; then reduce the heat to 350 degrees and bake for a further 15 minutes or until set.

Double Boilers

A DOUBLE boiler, though not an essential piece of kitchen equipment, is a convenient utensil. It consists of one container, in which the food is cooked, resting in another partially filled with boiling water. An improvised double boiler may be made by using a basin or jug standing in a saucepan in which there is sufficient boiling water to bubble half way up the outside of the jug. (Whatever is being cooked in the upper container cannot reach a higher temperature than that of boiling water and, not being directly in contact with the source of heat, will not burn.) This utensil is used in making "boiled" custard and similar dishes, the ingredients of which burn easily as, for example, cornflour moulds, lemon honey, and others containing largely milk and/or eggs. Oatmeal porridge requiring long, slow cooking is excellent when done in a double boiler, where it cannot burn if left unattended. A double boiler should have a wide, flat base for stability and close contact with the source of heat. The upper section should be rounded for easy cleaning, and should not have a deep groove on the inside. Steel, aluminium, high-grade enamel, and heat-resistant glass are all used for making this type of utensil.

—MAUD B. STRAIN, Field Officer in Rural Sociology,
Department of Agriculture, Dunedin

Above—A linking machine which sews the toes of nylon stockings. Below—The knitting of nylon thread into a complete stocking.

Choice and Care of Nylon Stockings

By LESLEY HARDING, Field Officer in Rural Sociology, Department of Agriculture, Auckland

TO many women nylon stockings are an indispensable part of their wardrobe. The main attractions are that nylon stockings wear well and rarely need to be darned. Perhaps there is a tendency today for nylon stockings to be taken for granted and treated more casually than in the days when a pair of nylons was a cherished possession.

A WOMAN who chooses her stockings intelligently and looks after them with reasonable care should, with luck, make them last for months.

Buying Nylon Stockings

A large selection of nylon stockings is offered the purchaser, and the size, gauge, and denier of the stockings as well as the more obvious things, such as shade and brand, should be taken into account in buying.

A good idea is to buy two pairs of the same shade so that if one stocking ladders, combinations of the other three can still be worn.

Foot Size

The foot size of the stockings should take into account the width of the foot as well as its length. For a foot of average width, the following chart gives the stocking sizes which correspond to shoe sizes:—

Foot Size of Nylon Stockings

Shoe size ..	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9
Stocking size ..	8½	8½	9	9	9½	9½	9½	10	10	10½	10½	11

For feet wider or narrower than average, for example, C, D, or AA. multiple shoe fitting, the sizes shown below are not suitable and it might be necessary to add or take off ½in. from the stocking size.

Length

No knitting machine can turn out a perfectly standard stocking each time, so for any particular foot size there is always some variation in length.

Some manufacturers of nylon stockings mark their products as having different lengths. Others do not mention the length of stockings and they must be measured in the shop before they are bought. If a tall person buys very short stockings, they are usually strained and will tend to ladder, whereas a shorter person with long stockings will find them wrinkling

Sewing the back seam.

round the ankles. Some guide as to the lengths of legs of nylon stockings is given in the table below:—

	in.
Short stockings ..	28 to 29
Average stockings ..	30 to 32
Long stockings ..	33 to 34 to 36 or 37

Gauge

The higher the gauge of nylon stockings the more loops of thread there are across 1in. of knitted stocking. Gauge varies between 45 and 66 and, especially for the lower denier stockings, it should be as high as possible. Stockings of gauge 66 have more give and because of the tightness of the knitting are less likely to catch and snag.

Denier

Denier denotes the thickness of the nylon yarn used in the knitting of the stockings. A thicker and stronger yarn might have a denier of as much as 60, whereas the sheerest of stockings are made of 12 denier yarn. In comparison the denier of an ordinary pin would be 3000. Therefore 12 denier nylon stockings are very fine and frail and should not be expected to wear as well as the heavier stockings.

For everyday wear which involves walking out of doors, housework, and driving cars 30, 40, or even 60 denier stockings should be worn. These are also useful to hide skin blemishes. The 12 and 15 denier stockings should be saved for special occasions.

Mediums and Seconds

A fault in the knitting of a stocking causes it to be rejected and regraded as medium or second. If the fault is not very serious, the stocking is graded medium, but if the fault is bad enough to need to be repaired, the stocking becomes a second.

Perfect nylon stockings cost from 10s. 6d. a pair, and it is possible to buy mediums for about 9s. 11d. or seconds at 6s. 11d. Different firms have different standards for grading stockings, but generally the grading given applies.

Colour

Nylon stockings should tone with the colour scheme of the clothing that is being worn, so that a woman who has several outfits might need a pair of nylons to match each.

As a rule darker shades of stockings have more of a slimming effect on the legs than the lighter shades.

Welt

A stocking is well constructed if the welt is at least 5in. long, including the shadow welt, which is the part that is strengthened but not double.

Mesh Nylon Stockings

Some brands of mesh nylon stockings do not ladder but split and can still be worn, because the stockings are so sheer that the hole is less noticeable. Other brands ladder, so it is wise to be sure that mesh stockings are guaranteed not to run. It is necessary to sacrifice some of the give with mesh stitch, so they are more likely to split than ordinary nylons.

Seamless Nylon Stockings

Seamless nylon stockings are knitted in tubular form and therefore need no seam down the back. A seam tends to exaggerate slightly bowed legs, so seamless stockings could be worn to advantage by people with them.

Decorative Heels

Heels, toes, and soles of nylon stockings are usually strengthened to protect them from extra wear and friction.

The thicker strengthening is sometimes emphasised by a decorative outline of black thread. Stockings with decorative heels are not suitable for wear in the daytime and should be worn, if at all, at night.

Nylon and Cotton Stockings

Nylon will not absorb moisture and as a result might cause a clammy feeling for some people. To make the foot of the stocking more absorbent in some higher denier stockings cotton thread is mixed with the nylon strengthening of the foot.

Elasticised Nylon Stockings

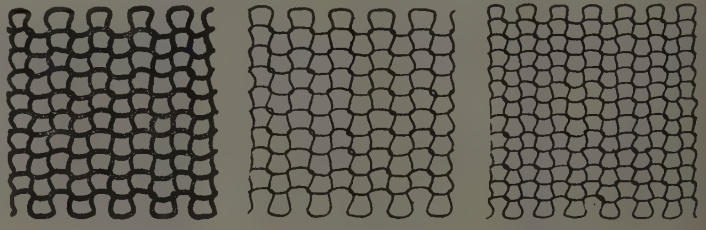
Elasticised nylon stockings are of fairly high denier and are knitted of special creped nylon thread which stretches. They can be bought in two foot sizes; one fits sizes 8½, 9, and 9½ and the other fits sizes 10, 10½, and 11. Before elasticised nylon stockings are put on they are about 19in. long but stretch to fit the leg. Perhaps because of the heavier nature of these stockings and their darker colour, they are more popular among older women.

Care of Nylon Stockings

Damage to nylon stockings is mainly caused by heat, snagging, strain, and poor washing methods.

Heat on Nylon Stockings

If nylon stockings are exposed to a high enough temperature, they melt, but if the temperature is not high enough to melt them, they will deteriorate if heated for long enough. So wearing nylon stockings while sitting close to a hot fire would not cause the nylon to melt, but in time to weaken. In the same way stockings should never be hung in front of a



Gauge 45 Denier 40 | Gauge 45 Denier 15 | Gauge 66 Denier 15

Diagrams showing gauge and denier of nylon stockings.

hot fire or heater or even in sunshine to dry. Nylon stockings that have been sitting in a hot sunny shop window for a fortnight or so are quite likely to disintegrate when they are first worn because of the effect of the heat on the nylon yarn. A glowing piece of cigarette ash is hot enough to melt the nylon and to cause a ladder.

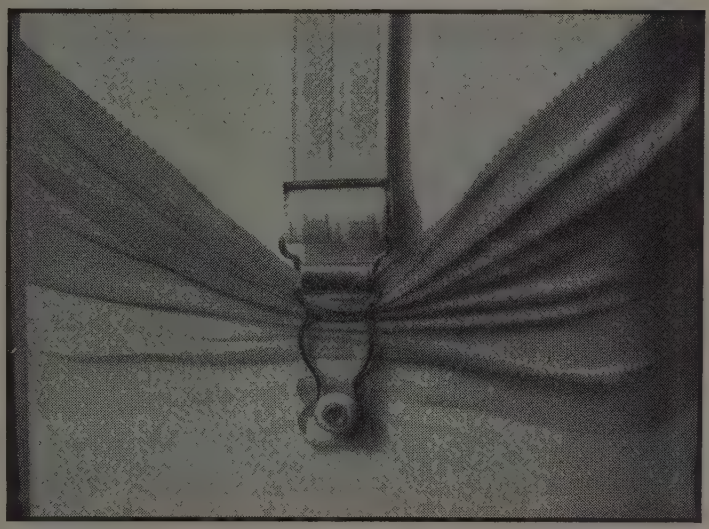
Snagging

A badly snagged thread will almost certainly break and the stocking will ladder.

Wearing nylon stockings the wrong side out makes them more likely to catch, sometimes even the lace on a slip being responsible. It stands to reason that this will happen because the knitted stitch is made up of tiny loops on the wrong side which are far more likely to catch than threads on the the smoother, flatter side.

By keeping nylons in a stocking holder (illustrated and described in an article "Tips for Travellers" in the September 1953 "Journal") or even in an envelope, there is less likelihood of their catching on fasteners of other clothes or on the rough lining of a drawer. They can be stored this way indefinitely, because they are not affected by moths and do not perish.

Roughened and dry skin or finger nails and rings may snag nylon stockings, especially those of low denier. It pays to protect them from hands and finger nails by wearing an old pair of cotton gloves while putting them on. Manufacturers of nylon stockings provide their employees with manicures and frequently inspect their hands to ensure that they are soft and smooth.



A suspender fastened below the welt and shadow welt of a stocking will very soon break threads and cause a run.

The safest way to put nylon stockings on is to gather the whole stocking in both hands and draw it gently over the foot and leg.

Do not hang nylon stockings to dry on a rough rail or where wind can blow them against any rough surface.

Strain

If nylon stockings are strained badly, threads are likely to snap and the stockings ladder.

Strain is usually the result of badly fitting stockings or poorly adjusted suspenders. Stockings should be held up firmly but not tightly. There should be no concertina effect round the ankles.

The suspenders are best attached about ¾in. into the welt of the stocking or perhaps a little lower. On no account should they be fastened into the stocking below the shadow welt. Adjustment of the stockings at the right tension should be obtained by shortening the suspender, and if this is not possible, the stockings themselves are too long.

Washing

Nylon stockings should be washed each time they are worn, partly to remove the dirt and partly to enable the stockings to be reset into shape.

A mild soap should be used in warm water, and the stockings gently squeezed in the suds. Rubbing should not be necessary, because particles of dirt are very quickly and easily released by nylon.

If nylon stockings are washed in a machine, they should be protected from other clothing by putting them into a nylon bag. The water should not be too hot, and the washing time should be very short.

Excess moisture should be removed by rolling the stockings in a towel and not by wringing, which might strain and snap the nylon thread.

The stockings should be dried away from any source of direct heat.

All photographs by Sparrow.

Setting the shape. The stockings are drawn on to the shapes, which are then put into an oven for a few minutes.

Sugared Fruits

CANDIED, crystallised, glace, and frosted fruits make unusual and attractive desserts. Some are used as sweetmeats and some as decorations for cold puddings and cakes, and none is hard to make. Methods of preparation and some recipes are given in this article by Betty M. Johnston, Field Officer in Rural Sociology, Department of Agriculture, Wellington.

SUGARED fruits can be prepared in different ways. They can be candied, crystallised, glace, or frosted.

Equipment

Special equipment is not necessary for sugaring fruits, but a candy thermometer, by giving exact recordings of syrup temperatures, contributes considerably toward success. It is suggested that an aluminium saucepan that is unpitted and free from dents be used for preparing the syrup. This will help to prevent sugar crystals forming in the syrup and giving it a grainy appearance and texture. Another precautionary measure is the use of a pastry brush or any other small clean brush to wash sugar crystals from the sides of the pan in which the syrup is heating. The syrup should not be stirred after the sugar has dissolved.

Candied Fruits and Peel

Candying is a method of preserving fruits, nuts, and peel by saturating them in sugar syrup and then allowing them to dry. The fruit should not be sticky on the outside.

Fruit

It is usual to candy soft fruits such as apricots, peaches, plums, and cherries. Stone and partly cook the fruits. Make a syrup from the fruit juice by dissolving 1lb. of sugar in a pint of juice. Boil the syrup for 5 minutes, add the drained fruit, and again bring the syrup to the boil. Pour the fruit and syrup into a bowl and leave the fruit to soak overnight. Next morning bring the fruit and syrup again to boiling point and stand them overnight. Repeat this process twice more, four times in all. Finally drain the fruit on a wire tray. Heat the remaining syrup to 234 degrees F. At this temperature it is possible to blow a bubble through the loop of a skewer or loop of fine wire which has been dipped into the hot syrup. Pour the syrup over the fruit and leave it to drain. Store the candied fruits between layers of waxed paper in airtight containers.

The angelica plant grows well in New Zealand, as is shown by this plant in a Wellington garden.

Left—Candied figs which have been coated in sugar while they were still moist. Right—Glace apricots, figs, and cherries.

Frosting cherries. Left—Tie pieces of thread to small clusters of fruit. Right—Dip the clusters into egg white and toss them in fine, granulated sugar.

Peel

Orange, lemon, or grapefruit peel may be candied, and frosted candied peel makes an excellent after-dinner dessert.

Choose fairly thick peels and cut them in halves or quarters. Soak the pieces overnight in salted water (1 teaspoon of salt to 1 pint of water) and then for a few hours in fresh water. Boil the peel in fresh water for ½ hour. Drain the peel, then measure sufficient water to cover it and make a syrup in the proportions of 1lb. of sugar to 1 pint of water. Add the peel when the syrup boils and simmer the syrup gently, with the lid on the saucepan, until the peel is tender enough to be pierced with a match stick. Remove the peel to a wire rack and dry it in the sun for 3 to 4 days or in a cool oven. Make a fresh syrup, using 2 cups of sugar and 1 cup of water to every 1lb. of peel. Add a pinch of cream of tartar and boil the syrup to the soft ball stage (245 degrees F.). If a little of the syrup is dropped into cold water, it should form a soft ball which may be flattened in the fingers. Dip the peel in the syrup, using kitchen tongs, remove it to a wire rack, and pour syrup in the hollows. Dry the peel thoroughly.

Frosting Candied Peel

After the peel has been dipped in the syrup roll it in finely powdered granulated sugar (castor sugar or rolled cane sugar). Dry it on a rack.

Angelica

Angelica is a plant which will grow well in New Zealand (see illustration on page 212).

Cut young, tender stalks into lengths of 3in. to 4in. Place them in a covered saucepan with a little water and bring them to the boil. Peel the stalks and boil them again until they are green. Drain the angelica and dry it with a clean cloth. Place the angelica with equal parts by weight of sugar in a covered dish or crock and allow the mixture to stand for 2 days. Again boil the angelica until it is clear and green and drain it well. Toss it in powdered sugar to frost it and dry it on a wire rack in a cool oven. Store the angelica in waxed paper in an airtight container. Candied angelica may be used as a decoration for cakes and cold desserts and it is a delicious sweetmeat.

Crystallised Fruits and Flowers

Crystallised fruits have a hard, thin, glossy coating of sugar, though the inner pulp is soft and juicy. Fresh fruit is used in this process, though a crystallised finish (that is a hard, dry, glossy surface) may be given to fruits first prepared by other methods.

Not only fruit but violet flowers and leaves, orange flowers, and mint leaves may also be crystallised and eaten as a dessert. Crystallised rose petals have been esteemed as a delicacy for hundreds of years and they will keep well if carefully stored.

Fruit

Dessert fruit such as plums, apricots, peaches, grapes, cherries, and fresh currants are suitable for crystallising.

Make a syrup in the proportions of 1lb. of sugar to ½ pint of water. Remove any stalks or leaves from the fruit and wash the fruit and dry it thoroughly. Dissolve the sugar in the water and heat the syrup in a saucepan, allowing it to boil until a temperature of 220 degrees to 225 degrees F. has been reached. At this temperature range a little of the syrup can be drawn into a long, unbroken thread between the thumb and forefinger. Do not stir the syrup, but wash the sugar from the sides of the pan with a pastry brush dipped in cold water. Stand the pan in cold water and dip the fruit into the syrup, using kitchen tongs. The fruit should be drained on a wire rack or on a greased dish. A frosted finish may be given to the fruit by rolling it in castor sugar after it has been dipped in syrup.

Flowers

Wash and dry the flowers. Dissolve 1lb. of sugar in ½ pint of water and heat this syrup to boiling point. Add a pinch of cream of tartar and heat the syrup until it reaches a temperature of 240 degrees F. (A "feather" will form when the loop of a skewer is dipped into the syrup and is blown through.) Remove the saucepan from the heat, place the flowers in the syrup, and reboil the syrup. Carefully pour the syrup and the flowers into a bowl and leave them soaking overnight. Next day drain the flowers. Dissolve another ¼lb. of sugar in the syrup and heat the syrup to 240 degrees F. Pour this syrup over the flowers and leave the flowers to soak overnight. Drain the flowers next morning and reboil the syrup. Add the flowers, remove the pan from the heat, and stir the syrup gently until it begins to appear cloudy. Pour the crystallising syrup and the flowers on to greased paper, shaking the paper to keep the flowers separate. Allow the flowers to dry before storing them in airtight containers.

Glace Fruits

Glace fruits are somewhat similar to candied fruits, being prepared by saturating them in sugar syrup, but they should be moist and sticky on the outside.

Glace cherries are common in cake mixtures or as decorations on cakes and puddings. Less familiar are the collections of glace fruits which once graced Christmas and party tables. With a little effort a most professional array of these sweetmeats may be made. Any good-quality fruit, either tinned or fresh, may be used. Fresh fruit should be carefully pre-cooked until it is tender but unbroken.

Preparation of Syrup

Make a syrup of 1 pint of unsweetened fruit juice and ¾lb. of sugar. Soak the fruit in this syrup for 24 hours. It should be pressed firmly under the syrup, a saucer or soup plate being used as a weight. The syrup is

reboiled each day for several days, its strength being increased progressively.

Sugar additions: 2oz. of sugar are added to the syrup each day for 4 days, the syrup being reboiled each time and then poured over the fruit again. On the next day (the sixth day after the syrup was made) dissolve 3oz. of sugar in the syrup, add the fruit, and boil it for 3 to 4 minutes. Leave the fruit to soak in the syrup for 48 hours before repeating this last step. Finally, on the twelfth day dry the drained fruit in a slow oven or in a warm place.

Glazing Process

Glaceing syrup: Dissolve 1lb. of sugar in ¼ pint of water and bring the syrup to the boil without stirring it. Holding the fruit in kitchen tongs, dip it into a little of the syrup in a cup or bowl. Place the fruit on a wire rack standing over a dish. Keep the syrup in the saucepan covered and keep it warm by standing it in hot water (a double boiler is ideal for this). The syrup in the cup will need to be replaced, as it quickly becomes cloudy. Allow the fruit to dry and store it on waxed paper or in the small paper cups from a chocolate box. Place it in an airtight container.

Marron Glace

Marron glace is a sweetmeat made from chestnuts. Ingredients are:—

1 pint of shelled chestnuts
14oz. of sugar
¾ pint of water
Juice of ½ lemon
Vanilla essence

Lightly slash the outer skin of the chestnuts and boil the nuts for 5 minutes. Shell and skin them. Soak the nuts for 4 hours in water to which the lemon juice has been added. Drain and simmer them in fresh water until they are tender. Boil the sugar and ¾ pint of water together for 20 minutes and then add a few drops of vanilla essence and the nuts. Boil the mixture for 10 minutes and then leave the chestnuts soaking in the syrup overnight. The next day boil the syrup alone for 10 minutes and then add the nuts and bring them to the boil. Soak them overnight. Again next day reboil the syrup for 10 minutes and then add the nuts and bring them to the boil. Drain the nuts. Boil the syrup until it is very thick. Dry the nuts in greased dishes in a slow oven, pouring a little syrup over them from time to time until it is all absorbed. Store as for glace fruit.

Frosted Fruits

Frosting gives a crisp, sparkling coat of finely granulated sugar, which adheres to a thin film of either sugar syrup or egg white.

Fresh fruit so treated is a very attractive dessert which is easily and quickly made. Cherries, red currants, and grapes make an especially colourful display. If necessary, wash and dry the fruit. Tie pieces of thread to small clusters or to the stalks of the fruit. Make a syrup of 2oz. of sugar, and 1½ fl. oz. of water and boil it for 2 to 3 minutes. Alternatively a lightly beaten egg white may be used for coating the fruit. Dip the clusters or individual fruit into the syrup or egg white and toss them in finely granulated sugar. Dry them on a wire rack. Remove the threads and serve the fruit on a glass dish.

Use of Herbs in Cookery

By NELL MACPHERSON, formerly Field Officer in Rural Sociology, Department of Agriculture, Auckland

THE use of herbs in cookery is probably as old as cookery itself, and different herbs traditionally have different purposes. Though some of these old beliefs are dying out, herbs will always be used to give flavour and distinction to different dishes. A herb corner in the garden is always attractive and a person with imagination can have both a fragrant garden and distinctive meals.

THE herbs most commonly grown in New Zealand are mint, thyme, parsley, chives, and sage. Horse-radish, mustard, cress, marjoram, chervil, tarragon, dill, sweet basil, and sweet bay, though not so often grown, are also very useful in cookery. Some combinations and uses for herbs are given below, but flavourings are a matter of personal tastes and with a little experimenting many satisfying combinations can be made.

Perhaps the two most famous herb mixtures are the "fines herbes" and the "bouquet garni" of the French. Fines herbes is a mixture of chives, parsley, chervil, and tarragon and is used in salads, soups, omelettes, and fish dishes. Bouquet garni is a mixture of parsley, thyme, bay, and marjoram and is used more for dishes such as those cooked in casseroles, stews, and soups.

Herbs are recommended for different dishes as follows:—

Mint: Lamb, mutton, peas, potatoes, pea soup, and fruit drinks.

Thyme: Stuffing for turkey and fowl, salads, sausage mixtures, and scrambled eggs.

Parsley: Salads, soups, white sauces, sandwiches, and as a garnish for savouries.

Chives: Salads, mashed potatoes, fish, eggs, and sandwich and savoury fillings.

Sage: Stuffings for duck, geese, heart, and steak, cheese dishes, and sauces. Sage is excellent for wild pork either in a stuffing or by itself.

Horse-radish: Roast beef, pickles, and very sparingly in salads.

Mustard: Salads and sandwiches.

Cress: Salads and sandwiches.

Marjoram: Egg dishes, salads, mince, and boiled fish.

Chervil: Salads, mashed potatoes, and egg dishes.

Tarragon: Tarragon vinegar for dressings, fish dishes, and sauces.

Dill: Pickles and white sauces for meat dishes.

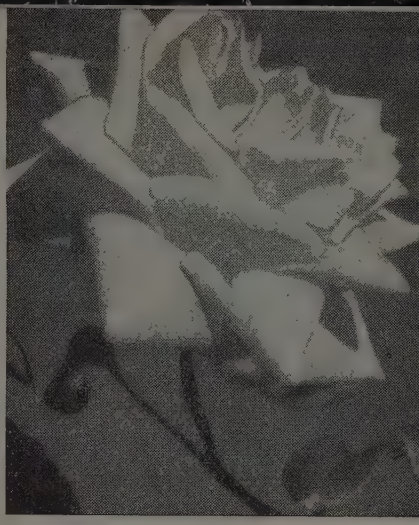
Sweet basil: Salads and stuffing for tomatoes and fish.

Sweet bay: Pickles, soups, and stews.

Nasturtium: Nasturtium is regarded as a flower rather than a herb, but the young leaves are excellent in salads and sandwiches.

HEADING PHOTOGRAPH: Bouquet garni. A—Parsley. B—Borage. C—Thyme. D—Spearmint. E—Balm. F—Sage. G—Yarrow. H—Marjoram. I—Tarragon. J—Winter savoury. K—Bay.

Rose Culture in Flower Garden



THE Queen of Flowers is a very appropriate name for the rose, as no other plant will give the same number of delightful flowers over so long a season year after year. In the following article K. H. Marcussen, Horticulturist, Department of Agriculture, Christchurch, discusses the types of roses that are grown in the flower garden, how to care for them to ensure an abundance of flowers, and how to keep the plants free from diseases and pests. The section on flower garden work for March is by M. Joanna Lockie, Horticultural Instructor, Department of Agriculture, Auckland.

ROSES have been grown for centuries, but it was not until the first hybrid tea rose was raised nearly 90 years ago that roses as they are known today were evolved.

Rose culture has expanded since then and today there are few gardens without roses.

The National Rose Society in New Zealand, which was formed in 1931, has now a very large membership and through the many provincial branches much information about rose culture is given.

Types and their Uses

The hybrid tea roses form the most important and most popular group; nearly all the well-known varieties, Crimson Glory, Etoile de Hollande, Peace, etc., are among them. They may be grown as bushes or standards and many have sported and are available as climbers; consequently they can be used in various positions in the garden. The hybrid tea roses are the most popular for cut flowers; even a specimen bloom can look delightful in a suitable vase.

The hybrid polyantha or floribunda roses, which have gained in popularity during the last 25 years, are also available as bushes and standards, and a few as climbers. Their flowers are smaller than the hybrid tea roses, but are produced in large clusters; there are both single and double flowered varieties available in a wide colour range. They come into bloom a little later in the season than the hybrid tea roses, but have a more continuous season of flowering. Because of their habit of flowering they are very suitable for massed planting and are sometimes used for dwarf hedges. If they are used in that manner, best results are obtained by pruning them in the orthodox way, which will be described later.

Climbers may also be true climbers, not derived from a sporting dwarf rose, and of these the ramblers or wichuriana hybrids form a distinct group. Well-known ramblers are Dorothy Perkins, Excelsa, and Hiawatha. Most of the ramblers are very susceptible to mildew. Paul's Scarlet, perhaps the most popular climbing rose, is a hybrid wichuriana, but has larger flowers than the others in this group.

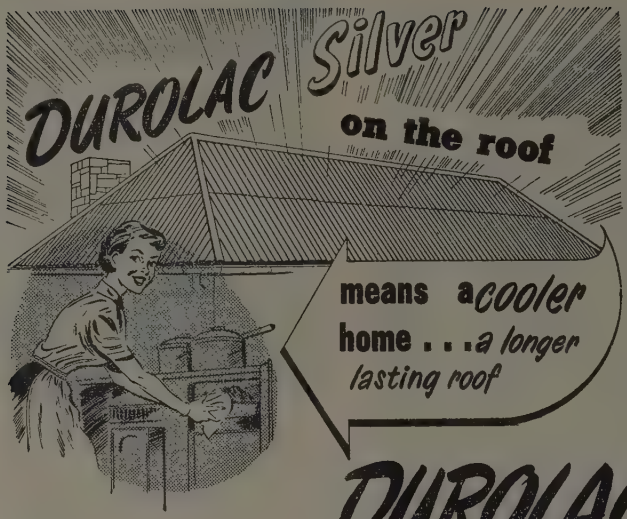
Bush Roses

Bush roses are used for planting in separate beds and in mixed borders or shrubberies. In mixed borders or shrubberies better displays are achieved if several roses are planted together in groups rather than if they are scattered individually. There is then less likelihood of their being neglected when cultural treatment is required.

Standard Roses

Standard roses differ from bush roses only in height; they have been budded on a longer stock or "brier" as it is often called. Most standards are 30in. to 36in. tall. The general use made of them is as specimen plants in a flower border, where they are usually underplanted with bush roses or bedding plants. This arrangement may be quite satisfactory if they are used in combination with another kind of plant, but if planted among

Left—Climbing roses on a fence give a good background for bush roses. Right—A good specimen of an old standard rose.



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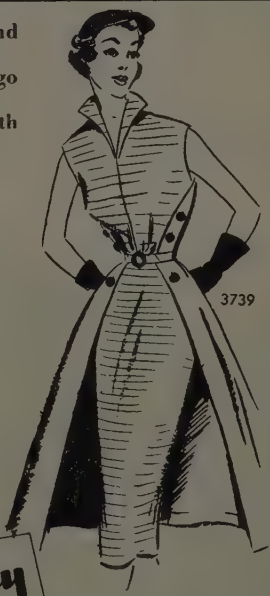

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Standard roses of various heights used with bush roses are very effective for use in a large garden. [R. W. Orr

bush roses to give height to the bed, they are not satisfactory. For such a purpose the standards should be only 12in. to 15in. high; they would then grow in association with the bush roses without showing a gap where only the supporting stakes and stems of the standards are seen.

In a large bed the height could be raised further by the use of normal size standards within a group of the shorter ones recommended. A fine example of such an arrangement is shown in the illustration above of a large rose bed in Kennedy Park Rose Garden, Napier. This circular bed is planted with bush roses in the outer circle, with each successive circle raised 1ft., terminating with a 4ft. standard in the centre. Only one variety is used, Frensham, a red hybrid polyantha, and the effect is most striking, as the whole bed forms a mass of colour throughout the season.

Climbers

Climber roses provide some of the most useful plants in the flower garden. Compared with the bush roses, climbers often have better blooms of any particular variety and in much greater numbers. They are perhaps most useful for clothing unsightly wooden fences, but when growing on trellis screens, wire fences, against buildings, or on pergolas or arches they show their beauty equally well.

Pillars can also be clothed with climbers; in fact climbers are often featured in rose gardens on specially erected structures. For this purpose the less vigorous type of climber is used with the result that some are listed in nurserymen's catalogues as Pillar Roses.

Climbing roses are sometimes grown in a mixed border or shrubbery without support as sprawling specimens. They are then either pruned short, 4ft. to 5ft., or may be left unpruned and have the tips of the canes tied to a peg in the ground.

Weeping Standards

It was explained how a standard rose was budded on a longer piece of stock than a bush rose. Where a stock grows 6ft. or longer a nurseryman will generally use it for a weeping standard. Whereas ordinary standards are budded with a variety of hybrid tea or hybrid polyantha, a weeping standard is budded with a variety of rambler rose. When grown in this manner the canes will droop in a weeping habit, but it is in fact the same type of rose as is used as climbers on fences.

The reason for its high cost is the scarcity of stock of sufficient length and the difficulty of successful budding.

Miniatures

During the last few years miniatures have become popular. These lovely small roses are available in a number of varieties, both as bushes and standards. They should be planted only in positions where their dainty beauty can be appreciated.

Miniatures can be propagated by cuttings and by budding. If they are budded on the usual stock, the dwarf habit of the plant will be lost, due to the added vigour of the stock, though the flowers will not be enlarged in the same proportion.

Species

Species are the wild roses, from some of which all the modern roses have been developed through interbreeding. They should never be compared to the garden roses, but have a beauty of their own. They are grown as shrubs, though some of them have a climbing habit. Species flower profusely in early summer and in autumn the hips give charm to the plants for yet another period.

Preparation for Planting

When a rose bed is established it is generally expected that it will remain in existence for many years. The preparation of the soil is therefore of major importance. Roses will not tolerate wet soil conditions for any length of time, and if drainage is required, it must be provided when the bed is being constructed.

The ground should be cultivated at least 2 spits deep, that is 18in. If the soil is very heavy or very light, the incorporation of half-rotted organic material such as compost or old stack bottom will improve it. During this operation the soil should remain relatively in its original position; that is the subsoil should not be brought to the top.

The bed should be prepared several months before planting to enable the soil to consolidate before planting time and also to allow any organic material that has been incorporated in the bed to decompose to a suitable condition.

Planting

The position where each new rose is to be planted should be marked before the plants are expected to arrive, so that if soil conditions are at all suitable, the plants can be put straight into their permanent growing positions. Roses are never completely dormant and the less the roots are disturbed the better the plants will establish. Plants should be thoroughly examined before planting and any damaged or broken roots cut off cleanly. Care should be exercised so that no damage is done to the plant and the soil should be made firm around the roots when the plant is placed in its prepared position.

Early planting is especially important in districts that experience dry periods during late spring. The plants will then have the chance to develop a good root system before such conditions prevail.

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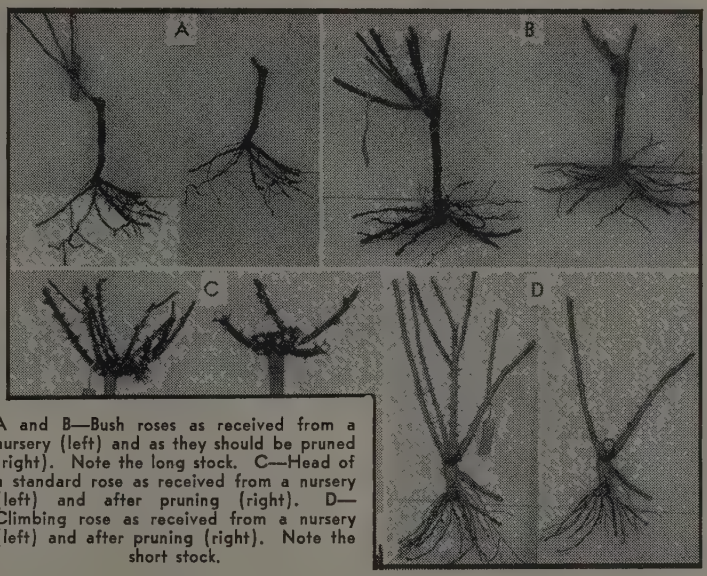
Bush and climbing roses are best planted with the union of stock and bud just below the ground surface. Unfortunately the supply of roses budded like this is limited. A good type of rose plant should have been budded within 4in. or 5in. of the base of the stock, but many roses are today offered for sale on an 8in. to 9in. stock. If such a rose were planted with the union below ground, the planting would be too deep, and of necessity the union must remain several inches above the ground. The difference between short and long stocks can be seen in the illustrations on pruning of new roses. It is wise to examine rose plants for the length of the stock before purchasing.

A batch of standard roses should all be of the same height so that they can be planted with the heads at a uniform level. It is preferable before planting to put in the stakes that are to support them. By doing this no damage will be done to the roots, as might otherwise be the case, and it is also much easier to ensure that the stakes are placed upright and of uniform height.

Old nylon stockings are excellent for tying standard roses. Wire should never be used and padding should be placed under a tie of twine or cord.

It is important to use stout stakes of durable material and one of the ties should be close to the head of the plant to prevent damage or the possibility of its snapping off in strong winds.



A and B—Bush roses as received from a nursery (left) and as they should be pruned (right). Note the long stock. C—Head of a standard rose as received from a nursery (left) and after pruning (right). D—Climbing rose as received from a nursery (left) and after pruning (right). Note the short stock.

Pruning

When plants arrive from a nursery they have usually been cut back by the nurseryman to facilitate handling and packing, but they are not pruned. Early planting has been recommended, and in that case the roses should not be pruned until the normal pruning season, which is during July and August, varying slightly according to locality.

For general garden display there is nothing gained by early pruning; if it is done at the proper time, the new shoots will make rapid growth and will be less subject to adverse climatic conditions and attacks by pests and diseases.

Newly planted hybrid tea and hybrid polyantha roses should be pruned rather hard to compensate for the loss of roots during transplanting. This should, however, not be done to climbing roses where it may cause a climbing sport to lose the climbing tendency; these should only be cut back cleanly to the nearest suitable bud and if necessary some of the shoots should be removed completely.

To grow good roses it is necessary to keep the bushes growing vigorously. This must be the prime consideration when pruning. As the best flowers will arise from the wood that developed the previous season, this should be preserved as much as possible, and the older branches should be pruned away to give the younger wood the best chance to develop. The bush should also be opened up to allow for free circulation of air, which will assist in keeping down the incidence of fungous diseases. Shoots that have developed from or near the base of the plant should preferably be left as they will assist in keeping the plants squat.

Suckers, which sometimes break from the stock below the bud union, should be carefully removed. They should preferably be traced to their place of origin and cut out with a sliver of the stock to prevent the development of more.

Pruning cuts should be made cleanly with sharp secateurs and just above a bud, as shown in the illustration below, or close to a side branch. It is wise to cover all pruning cuts with a wound sealing compound to prevent diseases entering.

Hybrid tea roses, whether grown as standards or as bushes, are treated much the same.

[*R. W. Orr*

The correct and wrong ways of making pruning cuts. A—Correctly pruned. The main cut is made just above a bud, slanting down on the opposite side. B—A branch which has not been pruned cleanly. C—The pruning cut is made incorrectly straight across the branch. D—The pruning cut is slanting the wrong way.

A hybrid tea rose before pruning (left), pruned the long method (centre), and the short method (right).

Standard roses are generally pruned more for shape, which is not so important with bush roses. One of the reasons for recommending the planting of bush roses with the unions below the surface is that they will then more readily produce new shoots from the bases. This tendency is restrained on standards, where the wood will dry out.

Longer pruning has been advocated by many authorities in later years and undoubtedly more blooms will develop on the plants, but a plant that has been pruned long for a few years will become leggy and without leafy growth at the base. Then the beauty of it as a bush will have been lost.

Watershoots, which develop from the bases of the plants and produce a large cluster of flowers at the top, will generally not be ripe enough to prune back the first year. They should either be removed completely at pruning time, if not required for building the plants up, or else cut off just below the place where the flower stalks branched off; after another season's growth they can be pruned back.

The principle in pruning hybrid polyantha roses is to remove old wood and long prune new wood.

The principle in pruning hybrid polyantha roses is to remove as much as possible of the wood which is more than a year old.

The strong basal shoots which develop on climbers early in summer will not flower the first season, but the following year these canes will produce a much greater number of blooms than the older ones.

The principle in pruning climbing roses should therefore be to preserve the new strong growth during summer and at pruning time replace as many as possible of the old canes with new. Old canes that must be left should have the side branches pruned back or some may be left longer to fill any spaces on the support.

Climbing roses should be tied up at pruning time and all ties should be renewed every year. It is then unnecessary to use wire for the ties, and if done with strong twine, the plant will be secure for the next 12 months. The canes should be spread out on the support and laid as near the horizontal as possible to encourage flower formation.

When climbing roses are being trained on a close-boarded fence it is best to pull wires a short distance away from the fence, on 2in. x 2in. battens, and tie the roses to the wires. This will allow better development of the shoots and give more air circulation. A distance of 10in. to 12in. between wires is satisfactory.

Vigorously growing rambler roses may have all the old wood removed when flowering has finished. They will flower only once in the season and such pruning will provide better growing conditions for the new shoots during the remainder of the season.

Climbers such as Banksia should not be pruned as outlined, but should only be lightly trimmed back.

Pruning of species is mainly done to shape the bush and any dead wood should be removed. The spent flowers should remain on these plants to facilitate formation of the hips.

Summer Pruning

When the new shoots break away in late spring it may be advisable to remove some to ensure that those shoots placed in the best positions are able to develop strongly. This is more important on new plants, but there is no reason to remove the flower buds the first year after planting.

Spent blooms should be removed at frequent intervals during the flowering periods, not only for the sake of tidiness, but to prevent formation of seed heads, which is a waste of plant energy.

When flowers or spent blooms are cut a reasonable length of stem should be removed. New shoots have generally started to develop on the old flower stem and a clean cut should be made just above one of these. New growth will then come away quickly, resulting in more flowers.

Mulching and Manuring

The type of soil used for growing roses is not nearly as important as the manner in which it is looked after. The desirability of deep cultivation before planting has been stressed, but it is equally necessary to keep the soil in good heart once the roses are established. This can be done only by adding organic material to the rose bed every year.

A mulch can be kept on during the hot season and will help to conserve moisture and to keep the soil cooler; it will also reduce weed growth. Such a mulch should be put on only after

Upper—Branch of a climbing rose before and after pruning. Lower—A well-trained climbing rose before and after pruning.

the bed has been thoroughly watered and cultivated and may consist of any dead plant material. Straw and grass cuttings are often used. Grass cuttings are excellent, but should not be put on too thickly at any one time. The mulch should be kept a little away from the actual shoots of the rose. When autumn rains commence the mulch should be dug in.

Many flower gardeners, however, do not like the look of a summer mulch and the organic material can be composted instead and put on immediately after the winter pruning and dug into the top 3in. of the bed. To some extent it will act as a surface mulch, but hoeing can be done and the bed looks tidier. If animal manure or rich compost is used as a winter dressing, the need for an application of fertilisers may be eliminated.

A universal fertiliser mixture for roses cannot be given, as the condition of any particular soil and the quality of the organic material supplied must be taken into account.

It can be stated as a basis for consideration that potash should not be neglected, as it helps to harden growth and makes the plant less susceptible to disease; potash may also help to intensify colour in the flowers. Applications of 1oz. or 2oz. of sulphate of potash per plant should be adequate.

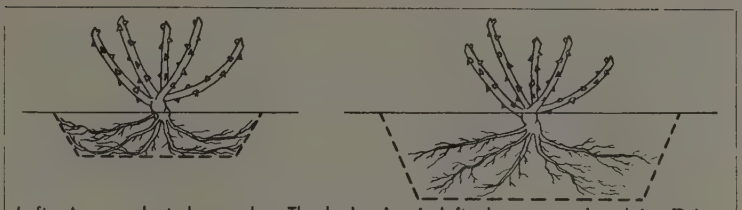
If it is decided to apply a general fertiliser, 2oz. to 4oz. of blood and bone may be applied to each plant.

Fertilisers are of greatest benefit to the plants when given in late spring. Feeding late in the growing season will promote soft growth which is liable to be affected by frost and also by die back after pruning.

Roses generally do not require liming, but if heavy dressings of organic materials are applied annually, or where the soil is known to be fairly acid, a light dressing of lime will sometimes be beneficial.

Propagation

Roses are mainly propagated by budding the selected variety on to a rooted cutting of stock. The stock commonly used is a thornless variety of *Rosa multiflora*. Some varieties can be raised from cuttings fairly easily, especially the ramblers; Paul's Scarlet, for example, is sometimes raised from cuttings commercially.



Left—A rose planted wrongly. The bud union is left above ground and insufficient space has been left for the roots to be spread properly. Right—A rose planted correctly.

All cuttings, whether of a variety or of the stock, should be taken in late autumn or very early winter. Very little success will result from cuttings taken at pruning time.

Cuttings should be made from mature wood of the past season's growth and be 6in. to 8in. long. The lower end should be cut just below a bud or leaf mark and the upper end above the bud as an ordinary pruning cut. They can be inserted in ordinary garden soil to a depth approximately three-quarters of their length; a little sand placed at the base of the cutting will assist rooting.

To ensure budding close to the bases of the cuttings they can be inserted on a ridge, which can be levelled out once rooting has taken place.

When preparing cuttings of stock all the buds that would be left under the ground are removed, each by a shallow cut; for bush roses the two top buds only are left. This is to prevent suckers from developing.

Budding takes place during January or early February the following year and saleable plants will have developed in 2 years from the time the cuttings were taken.

Precautions with H.E.T.P. and T.E.P.P.

Particular care should be taken when the organic phosphorus insecticides H.E.T.P. (hexaethyl tetraphosphate) and T.E.P.P. (tetraethyl pyrophosphate) are being used. Gardeners should not eat, drink, or smoke when handling them and they should wash their hands thoroughly after spraying. The chief danger is from the concentrated material and every precaution should be taken to prevent it from coming in contact with the skin. If any is spilt on the hands, it should be washed off immediately. Empty containers should be disposed of by burying.

Pests and Diseases

Though a formidable list could be made of the many pests and diseases which are liable to attack rose plants, mention is made only of the more common ones. This is followed by a list of recommended strengths at which to apply the control measures mentioned when spraying.

Aphis: The well-known green or black fly found on the buds and foliage. These may be carriers of virus and should be exterminated as soon as seen. Apply nicotine sulphate, H.E.T.P., or lindane.

Red mite: A minute sucking insect found on the undersides of leaves. The leaves will become greyish and on the under surface brown, grey, or red specks appear. Most prevalent under dry conditions. Apply nicotine sulphate plus summer oil or H.E.T.P.

Brown beetle: The adult of the grass-grub, it flies in the evenings during November and December, and will feed on foliage and flowers. Apply D.D.T.

Established hybrid tea roses before and after they have been pruned.

Lachenalia aurea.

Fuller's rose weevil and caterpillars: Apply D.D.T.

White scale: Seen mainly clustering on the stems in winter. Apply summer or winter oil.

Black spot: A fungous disease causing purplish or black spots on the leaves and stems. This disease is difficult to control and preventive treatment should be given. No affected leaves should be left on the ground; they should be collected and burnt. Apply, copper, ferbam, or thiram sprays.

Mildew: A fungous disease seen as a white or greyish powdery film on the new growth, often causing malformation of leaves. Apply sulphur dust or lime sulphur plus colloidal sulphur spray.

Rust: A fungous disease first seen as orange pustules on the backs of leaves. No affected leaves should be left on the ground; they should be collected and burnt. Apply ferbam, thiram, or sulphur sprays.

The following quantities of materials should be added to water to make 4 gallons of spray:—

Nicotine sulphate: 1 fl. oz. plus an activator (2oz. of soft soap or summer oil).

H.E.T.P.: ½ to ¾ fl. oz.

Lindane 16 per cent.: 1oz. Lindane 25 per cent.: ¾oz.

Summer oil: 8 fl. oz.

Winter oil: 1 pint, 12 fl. oz.

D.D.T. 50 per cent.: ½oz. D.D.T. emulsion: 1 fl. oz.

Thiram 50 per cent. wettable powder: 1¼oz.

Ferbam 50 per cent. wettable powder: 1¼oz.

Copper sprays: Bordeaux mixture, winter strength, 6¼oz. of bluestone plus 5¼oz. of hydrated lime. Bordeaux mixture, summer strength: 4oz. of bluestone plus 5¼oz. of hydrated lime. Copper oxychloride: 3¼oz.

Lime sulphur (3 fl. oz.) plus colloidal sulphur (1¼ fl. oz.).

Quantities of material required in dusts: Lindane, 1 per cent. active ingredient; ferbam, 10 per cent. active ingredient; thiram, 10 per cent. active ingredient; and sulphur, 50 per cent. active ingredient.

The balance can be made up with talcum powder. A dust of 19 parts of dusting sulphur and 1 part of copper oxychloride has given good results in controlling fungous diseases on roses. Professor Massey, U.S.A., has found a dust containing 50 per cent. of sulphur and 10 per cent. of ferbam most effective in controlling these diseases, according to an article in the 1953 Year-book of the United States Department of Agriculture.

Selection of Roses

When it is decided to plant roses for garden display a selection of varieties should not be made from exhibits at rose shows. The specimen blooms seen there will indicate what a certain variety can produce, but it is not safe to assume that such a variety will produce good garden roses.

It is best to make a selection after having seen a particular variety growing either in a nursery or in a rose garden.

The order should be booked immediately to ensure delivery of the chosen varieties. If the order is put in early, plants of better quality will generally be received.

The following are some of the most popular varieties for general garden use: Ena Harkness (red), Etoile de Hollande (red), Christopher Stone (red), Picture (pink), Violinista Costa (pink), Shot Silk (pink), Spek's Yellow (yellow), Mdm. P.S. du Pont (yellow), Peace (yellow), Virgo (white), Luis Brinas (bi-colour), and President Chausse (bi-colour).

Flower Garden in March

Roses

Budding of roses may be continued as long as the bark lifts readily. Any budding carried out previously should be watched and the ties cut as soon as the buds unite.

To keep bushes blooming as long as possible spent flowers and hips should be removed, unless it is desired to leave the rose hips to colour up for use in decorative arrangements. If seedling roses are to be grown, it is better to keep a record of crosses made, and work toward a definite goal rather than sow seed of unknown parentage. Seedling roses may not always give rise to show plants, but some interesting and useful variations may be gained and raising roses from seed can become an absorbing hobby.

Bulbs

Gladiolus corms may be lifted as they mature and stored in a dry place; the husks should be left on at this stage and thoroughly dusted with D.D.T. to kill any thrips which may be present.

Early spring flowering bulbs should be planted first during autumn: Lachenalia, ranunculus, anemone, crocus, and early flowering narcissus such as Paper Whites and Soleil d'or may all be planted now.

Bulbs which grow easily in sunny borders are lachenalia, romulea, sparaxis (commonly called sparaxia), tritonia, and ixia. Shallow planting is all that is required and these bulbs increase gradually to make a good display.

Narcissus, tulip, and hyacinth bulbs require deeper planting than the other bulbs, especially in light soils, and they respond to better soil conditions and good culture. As a precaution against fungous disease these bulbs should be dipped in a mercuric bulb dip before planting. All bulbs should be inspected for disease or insect damage. Any mouldy, rotten, or damaged bulbs should be destroyed.

Hyacinth, tulip, and iris bulbs can be easily planted by opening up a trench 6in. deep and the width of a shovel in well-worked soil. Before planting is done, the bottom of the trench should be loosened slightly, 1in. of sand should be run along it to improve drainage, and the bulbs set on the sand. According to the size of the bulbs they can be set across the trench in threes, fours, or fives, the fives being made up of a square with a bulb in the centre. Once the bulbs are planted a surface dressing of dried blood at 4oz. per sq. yd. may be worked into the soil. Water should not be poured on newly planted bulbs.

When bulbs are lifted and planted the smaller ones are as important as flowering sized bulbs, as they may be lined out and left to grow on and develop to flowering size.

Perennials

Lifting, dividing, and planting out of perennials may commence in March. Polyanthus will benefit from this treatment and should be replanted in a bed which has been well cultivated and manured by digging in old compost or decayed farmyard manure if possible. Polyanthus responds to feeding and this is essential if large flower heads are wanted.

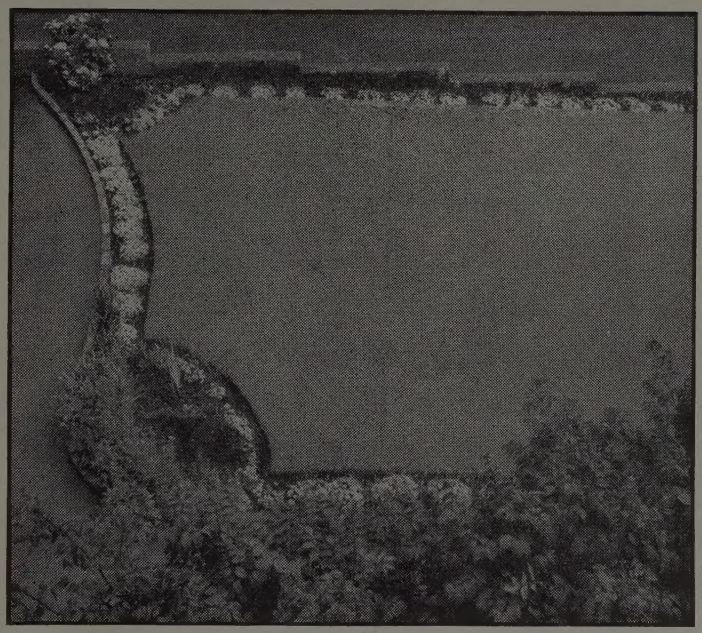
Cuttings may be taken of specially good violas, pansies, and verbenas; also of geraniums, pentstemon, and hydrangeas, though cuttings of the last three seem to root at almost any time of the year.

Herbaceous plants which are not due for their triennial lifting may be cut

back to within 3in. or 4in. of the ground. Garden scissors, shears, or secateurs are best for this autumn tidying up. They do a cleaner, neater job than breaking off the dead stem, and also avoid the possibility of loosening the roots. Healthy tops cut away may go on the compost heap, but diseased material should be burnt. Light cultivation by forking between plants completes the care of perennials at this time. All stakes should be collected and scraped clean of mud and repointed if necessary. The dead stems of perennials and stakes left with strings attached look dejected and drear in the garden.

Chrysanthemums should be firmly staked, and to grow large blooms disbudding is necessary. As soon as aphides appear spraying should be carried out with nicotine sulphate, 1 fl. oz. to 4 gallons of water, to which 2oz. of soft soap has been added. Where rust is suspected spray with 4½ fl. oz. of lime sulphur plus 1¼oz. of colloidal sulphur to 4 gallons of water and repeat at 8 to 10 day intervals if necessary. Make sure this spray does not touch any paint work as it will discolour it.

Earlier sowings of poppy and wallflower may be planted out in their permanent positions. Seed of stock, antirrhinum, calendula, nemesia, and winter flowering sweet peas may be sown now for winter and early spring flowering.



[*Sparrow*

Autumn is the best time to sow grass seed for a lawn of the quality shown.

Cyclamen

Cyclamen seed may be sown during February and March. The seed must be absolutely fresh and if home grown seed is to be used, it can be sown as soon as ripe. Seed boxes should be prepared in the usual manner, making sure there is adequate drainage at the bottom of the box. A suitable soil mixture is made up of 1 part of loam, 2 parts of leafmould, and 2½ parts of sharp river sand by bulk thoroughly mixed; to this should be added ¾oz. of agricultural lime for each bushel of the mixture. Seed should be sown 1in. apart each way and for about 1 month little activity is apparent. The corm forms first; then the leaves show. Once the leaves are large enough to hold each seedling should be potted in an individual 3in. pot, using the same soil mixture. Even while they are small the corms should be set above the ground, and care is necessary to avoid overwatering.

Shrubs

Any shrubs which have been layered should be weeded and kept cultivated, so that the layered portion receives light and air and can grow away freely.

Many shrubs can be increased by division now. The pieces planted out should have time to establish before the cold winter period. Shrubs usually increased by division by home gardeners are snowberry, *Symphoricarpos racemosus*, lilac, *Syringa* sp., japonica, *Cydonia* sp., the spireas and *Kerria japonica*, and any other shrubs which either sucker or produce many stems from the ground. Make sure that the plant is on its own roots, and that suckers have not arisen from a stock which may be of an unattractive species.

Lawns

Areas to be sown down in lawn this autumn should be cleared of any previous crop for at least 6 weeks before sowing. This allows the soil to firm down and consolidate, and also weed seeds will germinate and be killed before the lawn is sown. Autumn sown lawns usually give better results than spring sowings, as a warm soil is more conducive to free germination, and a thick strike of grass smothers many weed seedlings. If rainfall is not sufficient, watering should be carried out. Light but thorough watering is preferable to quick flooding. Just before sowing a fertiliser mixture of equal parts of sulphate of ammonia and superphosphate should be given at 1oz. per sq. yd.

Seed sowing mixtures vary depending on individual garden requirements. For a fine textured front lawn browntop 1 part by weight and chewings fescue 2 parts by weight sown at ½oz. to 1oz. of the mixture per square yard is used. For more serviceable lawns to stand heavy wear chewings fescue 20 parts by weight, browntop 10 parts by weight, crested dogstail 5 parts by weight, and yarrow 1 part by weight can be used sown at ½oz. per square yard.

If the area is subject to drought as well as heavy wear, the addition of clover ensures a green lawn in summer, and as chewings fescue and browntop die out under very dry conditions, crested dogstail and clover would take the wear.

Where tufts of paspalum develop in the lawn they create a nuisance with their wiry seed heads and rampant coarse growth. The easiest way to get rid of them is to dig them out. The hole left can be filled and firmed and resown with chewings fescue or preferably the original lawn mixture.

A lawn composed entirely of paspalum is most satisfactory in Auckland and northern districts. With each clump close to its neighbour there is no trouble with long side growths and the seed heads are removed by regular mowing before they have a chance to toughen up. An all-paspalum lawn should be sown during November-early December, later than normal spring sowing, as it germinates better at warmer temperatures, though it appreciates moisture as it establishes. It has a low percentage of germination and should be sown at the rate of 3oz. per sq. yd.

Trimming a Small Hat Shape

TRIMMING a small hat shape is not difficult, and those who like sewing and who have some imagination can very quickly make an attractive hat that costs very little.

CANVAS or felt shapes may be bought ready made in many different styles, and veilings, flowers, feathers, and covering materials are these days offered in profusion.

The upper illustration shows the hat shape ready for covering with silver-grey gros grain and the accompanying trimmings of grey dewdrop veiling and rosy coloured nylon sweet peas.

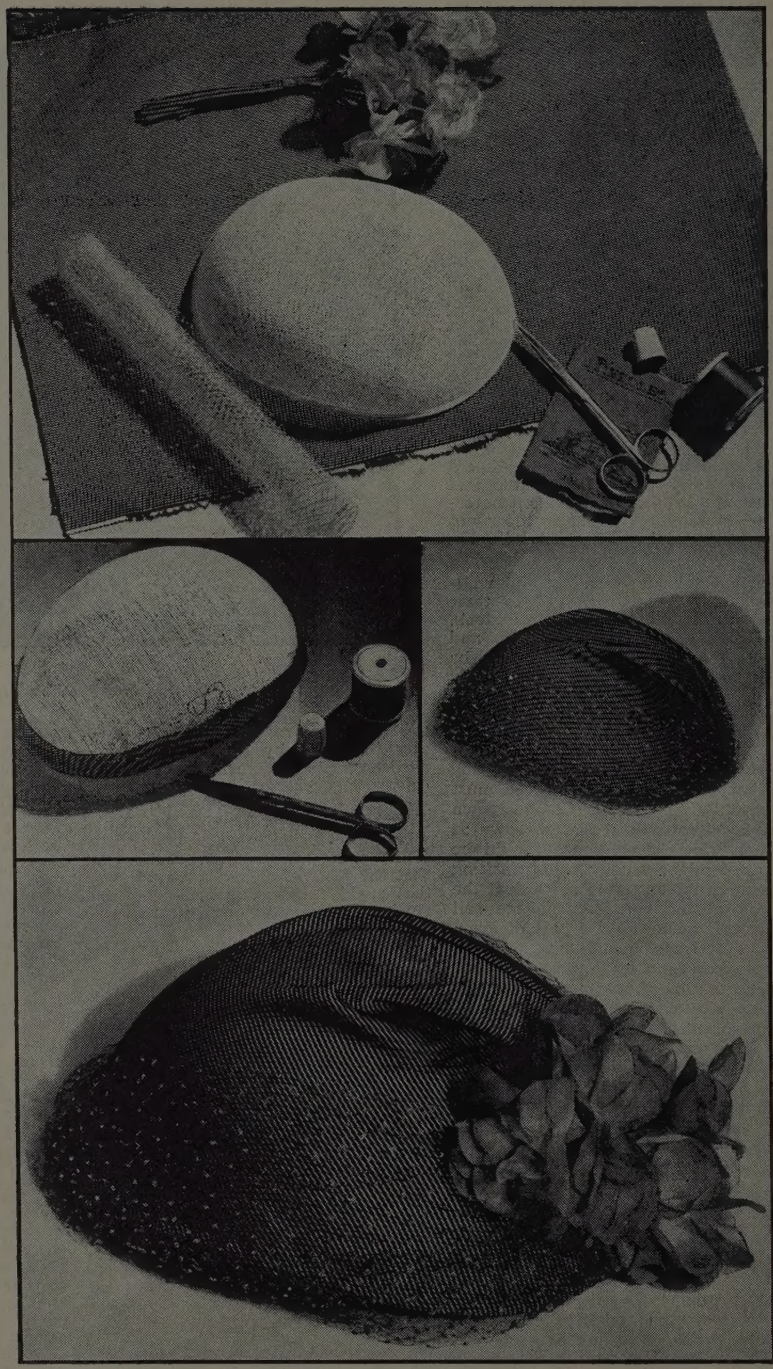
At middle left is shown a bias strip of the material being attached to the trim. To this will be first pinned and then hand sewn the covering material. A lining may be made or a bias inner band may be neatly sewn over the raw edge.

The Finished Hat

The middle right and lower illustration show the finished hat. The covering material was carefully pinned into position with the crosswise or bias grain running from the centre front of the crown. Two folds were made across the crown at the left back, the excess material cut away inside, and the covering hood was carefully stitched to the bias binding at the brim. A machine hemmed bias inner band covered the raw edges. Veiling was then loosely folded round the edge and caught with a stitch in two or three places. The flowers, with stems cut short, were loosely fastened to one side, able to be removed when a plainer hat was desired.

With a little patience and ingenuity several such hats could be made to match the dresses of a summer wardrobe with very little expense involved.

—BETTY M. JOHNSTON, Field Officer in Rural Sociology, Department of Agriculture, Wellington



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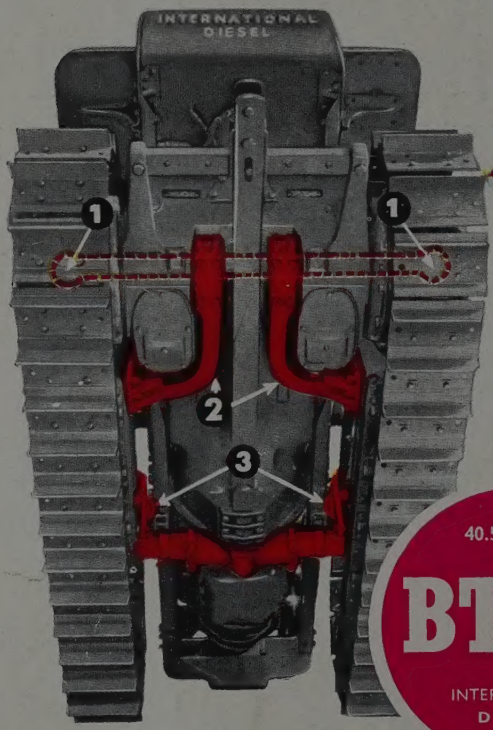

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